WINDS OF CHANGE: DRAWING ON WATER LAW DOCTRINES TO ESTABLISH WIND LAW

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Wind presents a promising, clean resource for energy production, which is likely to become even more significant in years to come given the challenges of climate change and the ever-increasing need for new sources of energy. However, while wind energy has many ecological and economic advantages, harvesting the energy from wind also presents some striking challenges with respect to property allocation and the use of natural resources. Specifically, the extraction of wind by one wind farm can reduce the wind available for others in the downwind direction. Despite the importance of wind resources, there is little judicial or legislative guidance on the governance of wind. This Note outlines potential structures for wind regimes by drawing on more mature regimes governing a similarly fluid and fugitive asset—water—which provides helpful guidance for crafting wind law.

This Note argues that, overall, an administrative permitting system that resembles the regulated riparian regime may be the best suited system for governing our wind resources. In addition to the permitting system, wind markets may be established to allow trading of wind rights between users so that the most efficient siting will take place through the market system. This may be especially useful in areas where the use of wind is more competitive. Urban localities, which are becoming increasingly relevant because of the recent expansion of distributed generation projects, provide an interesting example of such a competitive setting.

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INTRODUCTION

Although there is still much scientific uncertainty regarding the best mitigation measures to address climate change, it is widely agreed that one way to reduce its effects, or at least to slow the process, is to decrease our greenhouse gas emissions by changing our energy mix.[1] Wind is a major contender in the new mix. As opposed to fossil fuel energy production, wind has practically no carbon emissions and therefore helps mitigate the harmful environmental impacts associated with traditional fossil fuel energy production methods.[2] Indeed, wind energy production has grown significantly in recent years due to its environmental advantages and because it has become increasingly price-competitive.[3] And, given the potential wind energy capacity in the United States,[4] further growth is likely to occur.[5]

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1 *See, e.g.*, Alexandra B. Klass, *Property Rights on the New Frontier: Climate Change, Natural Resource Development, and Renewable Energy*, 38 ECOLOGY L.Q. 63, 66 (2011); Garrick B. Pursley & Hannah J. Wiseman, *Local Energy*, 60 EMORY L.J. 877, 879 (2011); Ronald H. Rosenberg, *Diversifying America's Energy Future: The Future of Renewable Wind Power*, 26 VA. ENVTL. L.J. 505, 506–08 (2008); *see also Human and Natural Drivers of Climate Change*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, www.ipcc.ch/publications_and_data/ar4/wg1/en/spmsspm-human-and.html (last visited Sept. 21, 2015) (describing dramatic increases in GHGs since 1750 and noting that these increases have been "due primarily to fossil fuel use and land use change" and have altered the "energy balance of the climate system"); *Wind Energy & Reducing Greenhouse Gas Emissions: The Role of Wind Energy in Addressing Greenhouse Gas Emissions*, AM. WIND ENERGY ASS'N, http://www.awea.org/Resources/Content.aspx?ItemNumber=5097 (last visited Sept. 21, 2015).

2 A report by the U.S. Department of Energy indicates, for instance, that under a scenario where 20 percent of energy comes from wind energy by 2030, we could avoid 825 million tons of CO_2 annually, and, by 2050, over 15,000 million metric tons of CO_2 emissions could be averted. *See* U.S. DEP'T OF ENERGY, 20% WIND ENERGY BY 2030: INCREASING WIND ENERGY'S CONTRIBUTION TO U.S. ELECTRIC SUPPLY 13–15 (2008) [hereinafter 20% WIND BY 2030], www.nrel.gov/docs/fy08osti/41869.pdf; *see also* Alan J. Alexander, Note, *The Texas Wind Estate: Wind as a Natural Resource and a Severable Property Interest*, 44 U. MICH. J.L. REFORM 429, 431 (2011); Joseph O. Wilson, Note, *The Answer, My Friends, Is in the Wind Rights Contract Act: Proposed Legislation Governing Wind Rights Contracts*, 89 IOWA L. REV. 1775, 1782 (2004).

3 *See* U.S. DEP'T OF ENERGY, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, 2014 WIND TECHNOLOGIES MARKET REPORT 46 (2015); *see generally* Mark Bolinger & Ryan Wiser, *Understanding Wind Turbine Price Trends in the U.S. Over the Past Decade*, 42 ENERGY POL'Y 628 (2011) (discussing the trends in wind energy prices over the last decade).

4 *See* U.S. DEP'T OF ENERGY, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, WIND VISION: A NEW ERA FOR WIND POWER IN THE UNITED STATES 21

Wind also plays an important role in our daily lives and our natural environment. It is a powerful element of nature that shapes landscapes by sculpting rocks or carrying sediments[6] and moving clouds.[7] Wind lifts vapor upwards, where it condenses into clouds, and it influences the oceans by creating waves.[8] Wind holds a significant ecological role in aiding plants in dispersal and reproduction by shifting pollens, leaves, and bacteria from one region to another.[9] Wind is also responsible for shifting polluted air downwind, thus dispersing the pollution over a larger area,[10] perhaps to the detriment of some and the benefit of others. Lastly, wind holds an important recreational role in our lives by enabling wind-surfing and kite-flying—or something as simple as carrying the aroma of fresh coffee or baked goods in the morning. Wind may be invisible, but its effects are apparent in our everyday lives, and without wind, life on earth would be quite different.

While wind energy has many ecological and economic advantages, harvesting the energy from wind presents challenges with respect to property allocation and the use of natural resources. The nub of the problem is that, despite its naturally replenishing properties, wind is not entirely unlimited. The process of extracting energy from the wind inevitably changes its current, since harvesting the kinetic energy locked in the wind results in a

(2015) (discussing the wind energy potential in the United States and noting that there are over "15,000 GW of technical wind resource potential, both land-based and offshore, that can be harnessed and delivered reliably").

5 As of 2011, wind energy accounted for roughly 3.3 percent of total U.S. electricity supply. *See* U.S. DEP'T OF ENERGY, 2011 WIND TECHNOLOGIES MARKET REPORT, at iii (2012), http://www1.eere.energy.gov/wind/pdfs/2011_wind_technologies_market_report.pdf. A report by the U.S. Department of Energy suggests that the United States has the potential wind energy capacity to meet at least 20 percent of its needs through wind power by 2030. *See* 20% WIND BY 2030, *supra* note 2, at 13–15.

6 C. DONALD AHRENS, METEOROLOGY TODAY: AN INTRODUCTION TO WEATHER, CLIMATE AND THE ENVIRONMENT 227–28 (Keith Dodson et al. eds., 8th ed. 2007).

7 *See id.* at 222, 232.

8 *See id.*

9 Although plants do not primarily spread their seeds through wind, it provides dispersal for a large percentage of the biomass produced by land plants. *See* JAMES D. MAUSETH, BOTANY: AN INTRODUCTION TO PLANT BIOLOGY 195–96, 208–11 (4th ed. 2008).

10 For an extensive review of the transportation of pollutants by the wind, see B. J. ALLOWAY & D. C. AYRES, CHEMICAL PRINCIPLES OF ENVIRONMENTAL POLLUTION 27–35 (2d ed. 1997).

depleted breeze in the downwind direction.[11] Extracting energy from the wind creates a "wind wake" or a "wind-shadow," similar to the wake created in the water behind a boat, such that the air stream is depleted and the wind current is altered, at least in the immediate wake of the turbine.[12] Therefore, although wind has the ability to regenerate over a certain time and distance, extracting wind alters the air stream in the downwind direction.[13]

This Note argues that extracting energy from the wind could thus lead to conflicts over the use of existing wind resources. If, for example, a farmer located downwind from the wind turbines wishes to construct a wind farm of her own, she would have less energy potential than would her upwind neighbor due to the depleted wind stream she was receiving.

This difficulty arises with large scale wind farms, but can be just as problematic in urban localities with regards to individual turbines positioned on rooftops, where residents may come into conflict over the use of the wind. Moreover, consider what would happen to the families living in a downwind portion of a neighborhood or city if too many families in the upwind area were utilizing the wind for energy production. It may be hard to picture such a situation today, but the effect could be similar to the construction of too many dams on a river, in the sense that the downstream users may suffer shortages.

The same problem can also exist even when the wind is not extracted but merely obstructed. Consider for instance the wind current in the wake of a particularly tall or wide building. Although the building does not extract the energy locked within the wind, it still changes the current. The ability of the family downwind from the tall building to enjoy the many advantages of wind— from cooling homes, to flying kites, to clean energy production—is decreased.

These wind wake conflicts can be seen as a problem of externalities.[14] Since the property interests in land have traditionally extended to the airspace above, each landowner feels free to harvest the wind blowing over her land. The landowner can produce energy from the wind, thereby gaining profits. Each

11 *See infra* Part I.A.
12 *See infra* Part I.A.
13 *See infra* Part I.A.
14 *See infra* Part I.B.

farmer enjoys the gains produced from the turbine but does not shoulder the costs imposed on the neighbors in the downwind direction. Likewise, a developer reaps the benefits of erecting a tall building but does not pay for the effect it causes on wind. Thus, both the farmer and the developer have no incentive to internalize the costs of the wind wake effects they created, which could ultimately lead them to consume the wind resources in excess.[15]

Given the potential conflicts over wind use, and because of the current expansion of wind energy projects, policy makers are likely to face a challenge with respect to regulating such projects and managing the existing wind resources soon. Moreover, despite the apparent significance of wind energy production and the importance of efficient allocation of wind resources, at present there is a lack of comprehensive legislative and judiciary guidance on this issue.[16]

This Note discusses which regimes we could employ to best manage and foster our wind resources while protecting individuals' rights to use wind as it blows over their land. I refer to these rights as "wind rights." Wind rights are essentially use rights that provide an entitlement to use a certain portion of the resource as it passes by. This includes the right to extract the airborne kinetic energy locked within the wind, although the right can also be used for 'in-stream' purposes.[17] Thus, wind rights can be used for producing electricity from the wind, and, indeed, many of the examples discussed in this Note will be framed in such terms.[18] But wind rights can also apply just as well to the ability to cool one's home, fly a kite, or foster seed pollination. To clarify, while many other studies regarding renewable energies focus on various mechanisms such as tax credits, loans, or renewable portfolio standards,[19] this Note takes a different view: it examines the wind

15 *See infra* Part I.B.

16 *See infra* Part II (discussing the current regimes regarding use of wind).

17 I use the term 'in-stream' to refer to any negligibly-extractive uses, ones that utilize the airborne kinetic energy within the wind current but which extract *de minimis* amounts of it. For example, both flying a kite and seed pollination are made possible by the kinetic energy in the wind, but they do not extract any meaningful amount of that energy.

18 *See infra* Part II (discussing wind rights mostly in terms of energy production).

19 *See* Ernest E. Smith & Becky H. Diffen, *Winds of Change: The Creation of Wind Law*, 5 TEX. J. OIL GAS & ENERGY L. 165, 168–76 (2010) (reviewing the mechanisms in place specifically with regards to wind); N.C. Clean Tech. Ctr.,

from a property rights perspective. This Note views wind as a resource subject to property rights and examines it accordingly.[20]

Drawing on analogous water regimes, this Note examines the applicability of four different water regimes to manage wind resources and craft emerging wind law. In brief, this Note argues that an administrative permit system that resembles the regulated riparian regime may be best suited for managing our wind resources. This is based on such a system's ability to provide sufficient certainty to spur investment in resource development, while at the same time reasonably accounting for a number of public interests.[21] In addition, once the property interests in wind are defined through a permitting system, they can be traded.[22] Thus, in some areas, 'wind markets' could be established. This would allow users to trade wind permits, such that the most efficient siting will take place through the market system. A market mechanism may be especially useful in areas where the use of wind is likely to be more competitive, such as residential or urban settings.[23] Lastly, traditional riparianism may also apply in certain locations, mostly in regions where the use of wind is less competitive, and, in fact, a traditional riparian regime may be the

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N.C. State Univ., *Database of State Incentives for Renewables & Efficiency*, DSIRE, http://www.dsireusa.org/ (last visited Oct. 21, 2015) (cataloging the current State initiatives on renewables and energy efficiency). With regards to Renewable Portfolio Standards (RPSs), see, e.g., Francesca F. Bochner, *Water, Wind, and Fire: A Call for A Federal Renewable Portfolio Standard*, 25 DUKE ENVTL. L. & POL'Y F. 201, 202–04 (2014) (discussing recent developments with regards to RPSs in the United States); *id.* at 206–09 (regarding international RPSs); *see also* Timothy P. Duane, *Greening the Grid: Implementing Climate Change Policy Through Energy Efficiency, Renewable Portfolio Standards, and Strategic Transmission System Investments*, 34 VT. L. REV. 711, 759–66 (2010) (explaining the structure and function of RPSs and discussing some notable examples in the United States).

20 This Note takes a broad understanding of 'property.' This entails recognizing an individual interest in using a portion of the wind (perhaps under restrictions, such as place, amount, or time). However, this does not require any particular means of protecting that interest. As will be illustrated in Part II below, the rights themselves can have various structures and can be protected by different institutions, such as courts or legislators. More simply, they can be recognized de facto by the users themselves. Any time an interest in the use of the wind is recognized and protected, it falls within a broad understanding of property and therefore is within the scope of this Note.

21 *See infra* Part IV.C (discussing the application of regulated riparianism to wind).

22 *See infra* Part IV.D (discussing the idea of setting up a "wind market" that would be analogous to water markets).

23 *See id.*

de facto regime in many areas today.[24]

The Note proceeds as follows. Part I illustrates the potential complexities and conflicts arising from wind use given the wind wake effects and suggests that these present an externalities problem. Part II briefly describes the current legal regimes governing wind resources (or lack thereof). Part III explains why drawing on water regimes might be fruitful. Part IV then illustrates four possible water regimes in the United States and discusses the potential applicability of existing water regimes to wind resources, examining the advantages and complexities of each regime in this respect.

I. UNDERSTANDING THE PROBLEM

A. *The Complexities Associated with Extracting Energy from the Wind*

Given the current expansion of wind energy projects, policy makers are soon likely to face a challenge with respect to regulating such projects and managing existing wind resources. Since property interests in land have traditionally extended to the air space above it, each landowner currently feels free to harvest the wind blowing over her land.[25] The landowner can thus produce energy from the wind, gaining profits.

However, the process of extracting energy from the wind changes its current, as the use of energy locked in the wind results

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24 *See infra* Part IV.C (discussing the application of riparianism to wind).

25 Users may feel free to harvest the wind if, for instance, landowners implicitly adhere to the *ad coelom* notion. The full statement of the maxim is *"cuius est solum, eius est usque ad coelum et ad inferos"* ("he who owns the soil owns also to the sky and to the depths"). For further discussion of the *ad coelum* rule, see Henry E. Smith, *Exclusion and Property Rules in the Law of Nuisance*, 90 VA. L. REV. 965, 992 (2004); Thomas W. Merrill, *Trespass, Nuisance, and the Costs of Determining Property Rights*, 14 J. LEGAL STUD. 13, 16 (1985); THOMAS W. MERRILL & HENRY E. SMITH, PROPERTY: PRINCIPLES AND POLICIES 171–79 (2d ed. 2012); Troy A. Rule, *Airspace in a Green Economy*, 59 UCLA. L. REV. 270, 278–79 (2011). Alternatively, they could assume a 'riparian' regime, which entitles all landowners underlying a wind current to extract a portion of the energy. *See infra* Part IV.A (discussing riparian regimes). Third, it could be drawn from an analogy to 'solar rights' or wildlife use rights. Solar rights provide for unobstructed access to the sun. Wildlife use rights stipulate that a landowner may capture game passing through her land, up to the moment it crosses over her property line. For the purpose of this analysis it does not matter what analogy is followed. The main point is that users extract energy without accounting for the downwind effects.

in a depleted breeze in the downwind direction. Wind is the flowing or movement of air on the surface of the earth, caused by differences in air pressure due to alternations in temperatures. Since warmer air rises over cooler air, a low pressure pocket is created.[26] Wind arises as air moves to fill cooler, low pressure areas.[27] The movement of air also allows for energy production: wind turbines create electricity by capturing some of the wind's kinetic energy and converting it to electric energy.[28] Wind causes the rotation of the feather-shaped blades of the turbine, which are connected to an internal gearbox that generates electric energy by spinning large magnets.[29]

Extracting energy from the wind current thus inevitably results in a weaker wind stream in the downwind direction.[30] This follows from the basic physics principle that energy acts as a closed system.[31] When energy is transferred from one form (for

26 AHRENS, *supra* note 6, at 203–14 (describing the physical forces that create and influence the wind); *see also* NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, *WIND RESOURCE ASSESSMENT HANDBOOK*, at 1-1–1-2 (2010), http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Biomass-Solar-Wind/wind-resource-assessment-toolkit.pdf ("[T]he air moves in response to pressure differences, or gradients, between different parts of the earth's surface. An air mass tends to move towards a zone of low pressure and away from a zone of high pressure.").

27 *See* ROLAND B. STULL, METEOROLOGY FOR SCIENTISTS AND ENGINEERS 205 (2nd ed. 2000); SIDNEY BOROWITZ, FAREWELL FOSSIL FUELS: REVIEWING AMERICA'S ENERGY POLICY 145 (1999).

28 Adam M. Dinnell & Adam J. Russ, *The Legal Hurdles to Developing Wind Power as an Alternative Energy Source in the United States: Creative and Comparative Solutions*, 27 NW. J. INT'L L. & BUS. 535, 539–40 (2007).

29 *Id.* at 539–40; *How Do Wind Turbines Work?*, U.S. DEP'T OF ENERGY, http://energy.gov/eere/wind/how-do-wind-turbines-work (last visited Sept. 21, 2015). The turbine's blades are also designed such that, as the wind speed increases, they gradually "feather," or decrease their angle of approach. As a result, the turbine spins at a constant speed regardless of the wind speed, and power generation can remain fairly steady. *See* STULL, *supra* note 27, at 207. The Public Health and Welfare Act follows a similar technical description in providing that "the term 'wind energy system' means a system of components which converts the kinetic energy of the wind into electricity or mechanical power . . . ." 42 U.S.C. § 9202(1) (2003). *See* STULL, *supra* note 27, at 207 ("The theoretical power available from the wind" is proportional to wind speed cubed.).

30 *Wake Effects of Wind Turbines*, DANISH WIND INDUS. ASS'N, http://http://waubrafoundation.org.au/resources/wake-effects-wind-turbines-danish-wind-industry-association/ (last visited Sept 21, 2015).

31 *See* STULL, *supra* note 27, at 212; PETER ATKINS & JULIO DE PAULA, PHYSICAL CHEMISTRY 28–56 (8th ed. 2006) (reviewing the first law of thermodynamics and how it governs the transformation of various forms of energy within a bio-system).

example, kinetic) to another (electric) "along any one streamline" (such as a flowing river or a breeze), the sum of changes equals zero.[32] Therefore, harvesting the kinetic energy locked in the wind through the turbine inevitably means there is less energy readily available in the downwind direction.[33]

The size and shape of the wind wake depend on a variety of factors, including the dimensions of the turbine itself and the physical ground conditions.[34] To illustrate this, initial data by the National Renewable Energy Laboratory (NREL) suggests that an average commercial wind turbine creates a wake that reaches about 700 meters.[35] The conjunction of several wind turbines, which typically happens on a windfarm, creates an even more dramatic effect: according to one study, the average wind wake distance downwind of a large commercial wind farm can reach as far as 60 km (approximately 36 miles).[36]

The airstream in wind wake areas is less suited for energy

32 STULL, *supra* note 27, at 211–12; *see* ATKINS & DE PAULA, *supra* note 31 (reviewing the first law of thermodynamics and how it governs the transformation of various forms of energy within a bio-system).

33 *See* STULL, *supra* note 27, at 212; DANISH WIND INDUS. ASS'N, *supra* note 30.

34 *See generally* STULL, *supra* note 27 (explaining the effects of ground conditions).

35 NAT'L RENEWABLE ENERGY LAB., NREL STUDIES WIND FARM AERODYNAMICS TO IMPROVE SITING 1 (2012), http://www.nrel.gov/docs/fy12osti/53609.pdf. Other sources claim that the wake will typically reach up to eight to ten times the length of the turbines' diameter. Kimberly E. Diamond & Ellen J. Crivella, *Wind Turbine Wakes, Wake Effect Impacts, and Wind Leases: Using Solar Access Laws as the Model for Capitalizing on Wind Rights During the Evolution of Wind Policy Standards*, 22 DUKE ENVTL. L. & POL'Y F. 195, 204 (2011); J.F. MANWELL ET AL., WIND ENERGY EXPLAINED: THEORY, DESIGN AND APPLICATION 423 (2d ed. 2009); *See also* Diamond & Crivella, *supra*, at 204 (noting that "downwind wake effect from an individual commercial wind turbine . . . can persist even longer where turbulence is low, such as in offshore locations"). The size of turbines varies. The GE 1.5 megawatt model consists of 35-meter blades (70-meter diameters). *See FAQ – Size*, NATIONAL WIND WATCH, www.wind-watch.org/faq-size.php (last visited Sept. 21, 2015); *Size Specifications of Common Industrial Wind Turbines*, AWEO, www.aweo.org/windmodels.html (last visited Sept. 21, 2015). Other popular turbine models have even longer blades of up to 45 meters (90-meter diameters). *Id.* Taken together, if the wake is eight to ten times the size of the turbines, this means these turbines can produce wakes of up to 720–900 meters.

36 *See* FRANDSEN ET AL., SUMMARY REPORT: THE SHADOW EFFECT OF LARGE WIND FARMS: MEASUREMENTS, DATA ANALYSIS AND MODELLING 30 (2007), www.risoe.dtu.dk/rispubl/reports/ris-r-1615.pdf.

production.[37] A turbine located in another turbine's wake path has less energy available for extraction[38] and is "less efficient at harvesting energy."[39] The magnitude of this impact "is a function of the number of turbines" upstream, as well as a range of complicated interactions between the wakes created by all preceding turbines.[40] To illustrate this, some studies estimate that the power output loss owing to wind-wakes could be about 10 to 20 percent; others suggest it can reach up to 40 percent.[41]

Overall, it is clear that the energy deficit from a wind wake is quite significant. Thus, although wind has the ability to regenerate over a certain time and distance, extracting energy from the wind inevitably alters the current in the downwind direction, if only on a local scale. Thus, I suggest that these wind wake effects could lead to conflicts over the use of the existing wind resources, or more specifically the use of the airborne kinetic energy locked in the wind. Given the diminished kinetic energy in the downwind direction, if a neighbor located downwind from turbines seeks to construct a wind farm of her own, she would have less energy

37 Diamond & Crivella, *supra* note 35, at 200 ("[W]ind exiting a turbine contains less kinetic energy than does wind before passing through a turbine. This diminished, turbulent wind from an upwind turbine reduces the energy entering downwind turbines, thereby decreasing the downwind turbines' overall energy output.").

38 B. SANDERSE, AERODYNAMICS OF WIND TURBINE WAKES: LITERATURE REVIEW 5 (2009), http://www.ecn.nl/docs/library/report/2009/e09016.pdf; R. J. Barthelmie & L. E. Jensen, *Evaluation of Wind Farm Efficiency and Wind Turbine Wakes at the Nysted Offshore Wind Farm*, 13 WIND ENERGY 573, 573 (2010) ("[W]ind speeds do not recover to their freestream value after encountering the first turbine . . . and thus are lower than the freestream . . . because kinetic energy has been extracted."); Diamond & Crivella, *supra* note 35, at 205 ("[D]ownwind turbines that experience wakes produce less power than upwind turbines, particularly compared to upwind turbines that receive wind in the freestream."); THOMAS E. KISSELL, INTRODUCTION TO WIND PRINCIPLES 274 (2010).

39 Diamond & Crivella, *supra* note 35, at 205. In addition to the reduced wind speed, the downwind turbines also "experience increased mechanical loads and diminished operational capacity" as "a result of vibration-induced fatigue on these downwind" turbines. This is another factor which contributes to the reduced power output of downwind turbines. *Id.* at 205–06.

40 *Id.* at 204.

41 *See* NAT'L RENEWABLE ENERGY LABORATORY, PREDICTING WIND POWER WITH GREATER ACCURACY 9 (2014), available at https://str.llnl.gov/content/pages/april-2014/pdf/04.14.1.pdf ("These wakes, which feature both reduced wind speeds and increased turbulence, are of key concern because they are associated with power losses of up to 40 percent, and they shorten the operational life span of turbine components").

potential than her upwind neighbor.[42]

Indeed, there is some initial evidence that such conflicts are beginning to occur. For instance, in Alameda County, California, two commercial developers seeking to construct wind farms on adjacent plots came into conflict when the downwind developer argued that the construction of a wind farm on the upwind land would diminish the energy available on the downwind plot.[43] A similar conflict arose between two commercial developers in North Dakota.[44]

Concerns over airborne kinetic energy have also been voiced by a plaintiff in Illinois, arguing that constructing a wind farm on

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42 Concerns over potential wind wake conflicts have also been mentioned by Troy Rule, who notes that, "with the recent spike in demand for wind energy, multiple developers are increasingly competing to develop wind energy projects in the same geographic areas and are vying against each other for the same wind . . . . In this competitive environment, an increase in wake interference conflicts is bound to follow." Troy Rule, *A Downwind View of the Cathedral: Using Rule Four to Allocate Wind Rights*, 46 SAN DIEGO L. REV. 207, 214–15 (2009).

Non-profit organizations focused on wind energy development have also voiced concerns about wind wake conflicts, noting that clear standards regarding the use of wind are "critical to preventing disputes over wind rights now and in the future," and absent such standards "conflicts among neighbors and among wind developers can arise." WINDUSTRY WIND EASEMENT WORK GRP., WIND ENERGY EASEMENTS AND LEASES: BEST PRACTICES AND POLICY RECOMMENDATIONS 3 (2005), http://www.windustry.org/sites/windustry.org/files/LandEBest-Practices.pdf.

43 The downwind developers claimed that the construction of a wind farm on the upwind plot would diminish the kinetic energy available to them for energy production. They challenged the construction of the upwind farm on the grounds that the local authorities were required to consider the effects of lost kinetic energy on adjacent properties and failing to do so violated their obligations under the California Environmental Quality Act. *See generally* CAL. PUB. RES. CODE §§ 21000–21177 (West 2014). The Superior Court accepted the claim, and an appeal was filed to the California Court of Appeals (1st District San Francisco). Telephone Interview with Howard Susman, Partner, Stoel Rives LLP (Oct. 4, 2012) (attorney for downwind developers). However, the case was eventually settled out of court. *Id. See* Windpower Partners 1987 et al. v. County of Alameda et al., No. A089107 (Cal. Ct. App. dismissed Nov. 27, 2000).

44 Florida Power and Light (FPL) had planned to install eighty commercial size turbines in Barnes County, North Dakota. At the same time another developer, Peak Wind, was also planning to develop a wind project downwind of the FPL site. Peak Wind voiced concerns about the potential wind wake effect that FPL's farm will create and the diminished returns it was likely to get on their site as a result. Lauren Donovan, *Two Energy Projects Competing for the Wind*, BISMARCK TRIB., (Feb. 22, 2008), http://bismarcktribune.com/news/local/article_4bd1f0d6-6616-512b-970f-b4301800f774.html. Apparently, a similar situation also occurred in Dickey County, North Dakota. *Id.*

the neighboring property would deprive her of "the full extent of the kinetic energy of the wind and air as it enters her property."[45] The same plaintiff recently brought another suit against the County Board arguing against an "amendment to the County's zoning ordinance"[46] that eased the requirements for wind farm construction; she claimed it would deprive her of the "'full extent'" of the airborne kinetic energy.[47] Judge Posner, writing for the 7th Circuit Court of Appeals, noted that "[a] reduction in wind speed downwind is an especially common effect of a wind turbine."[48] The issue of kinetic energy availability is also addressed in the *Contra Costa*[49] and *Romero*[50] cases, which are discussed in further detail below.

Concerns over wind wake effects are also reflected in state and agency "setback" requirements, established with the purpose of protecting the rights of downwind users.[51] A setback is a regulatory requirement that turbines be no less than a certain distance from the property line. Minnesota adopted a statewide setback requirement for siting turbines that "has been shown to protect wind rights and future development options of adjacent rights owners."[52] And similarly, the Bureau of Land Management (BLM) acknowledges wind wake effects and establishes a setback

45 Muscarello v. Ogle Cty. Bd. of Comm'rs, 610 F.3d 416, 419 (7th Cir. 2010). However, the case was dismissed on other grounds and the claim regarding the wind wake effect was not discussed on the merits. *Id.* at 425 (concluding that claims were not ripe because no windmills had been built yet); *id.* at 426 (discussing difficulties with federal jurisdiction in this case).

46 Muscarello v. Winnebago Cty. Bd., 702 F.3d 909, 910 (7th Cir. 2012).

47 *Id.*

48 *Id.* at 911. In this case the court found that the ordinance—as such—had not violated the plaintiff's constitutional rights. *Id.* at 913–14. However, the court does not seem to rule out the option of future nuisance litigation against any wind farm that might be constructed adjacent to plaintiff's property. *Id.* at 914–15.

49 Contra Costa Water Dist. v. Vaquero Farms, Inc., 68 Cal. Rptr. 2d 272 (Cal. Ct. App. 1997).

50 Romero v. Bernell, 603 F. Supp. 2d 1333 (D.N.M. 2009).

51 As the examples below illustrate, "setbacks" or "wind access buffers" are zoning restrictions that typically stipulate that wind turbines cannot be located at a certain distance from property lines. *See infra* notes 102–104 and accompanying text. By doing so, they seek to assure that neighboring property will not receive a depleted wind current, since the setback provides a recovery distance after the wind hits the turbine.

52 *See* Order Establishing General Wind Permit Standards, Docket No. E, G-999/M-07-1102, 4 (Minn. Pub. Utils. Comm'n Jan. 11, 2008). This setback also applies to State lands. *Id.*

requirement that is intended "to avoid potential wind turbulence interference issues with adjacent wind energy facilities."[53]

The wind wake dilemma can be especially problematic in areas where wind resources are less abundant, where the use of the wind is particularly competitive, and where the users are closer together. As mentioned, wind has the ability to regenerate over a certain distance, depending on the terrain and the friction it encounters on the way.[54] However, if the recovery period is too short, the wind may never regain its speed.[55] Therefore, the closer the landowners are to one another, the more likely they are to come into conflict over the use of wind.

An example of such a competitive environment could be found in urban settings due to the recent expansion of distributed generation[56] or "small wind" projects.[57] This trend is undoubtedly

53 Wind Energy Development Policy, Instruction Memorandum No. 2009-043 (Dep't of Interior Bureau of Land Mgmt. Dec. 19, 2008). *See also infra* Part II for discussion regarding the BLM wind rights regime.

54 The wind, like other moving forces, is affected by friction which slows it down. Therefore, the frictional drag of trees, rocks, valleys or even buildings can slow the wind down. *See* AHRENS, *supra* note 6, at 215.

55 This follows from the fact that the wind wake spans over a certain distance. *See supra* note 35 and accompanying text. The same idea is also apparent in the setbacks, *see infra* notes 51, 98–101 and accompanying text that purport to address the wind wake issues by distancing the turbines from property lines.

56 Distributed generation "can be defined as electric power generation occurring within distribution networks or on the customer side of the substation, as opposed to occurring in the large, centralized generation facilities built outside the distribution network on the transmission grid." Dennis L. Arfmann et al., *The Regulatory Future of Clean, Reliable Energy: Increasing Distributed Generation*, COLO. LAW., Oct. 2011, at 31, 31. *See also* Melissa Powers, *Small Is (Still) Beautiful: Designing U.S. Energy Policies to Increase Localized Renewable Energy Generation*, 30 WIS. INT'L L.J. 595, 599–603 (2012) (discussing both the advantages and the challenges of distributed generation); *see generally* DEP'T OF ENERGY, 2014 DISTRIBUTED WIND MARKET REPORT, http://www.energy.gov/sites/prod/files/2015/08/f25/2014-Distributed-Wind-Market-Report-8.7_0.pdf (discussing the growth trend in distributed wind generation).

57 The term "small wind" typically refers to individual windmills, mostly positioned on rooftops that generate no more than 100 kW. This definition is also adopted by the Public Health and Welfare Act (chapter 100, Wind Energy Systems), which provides that: "[T]he term 'small wind energy system' means a wind energy system having a maximum rated capacity of one hundred kilowatts or less." 42 U.S.C. § 9202(2) (2012). *See also* Christopher W. Fry, *Note and Comment: Harvesting the Sky: An Analysis of National and International Wind Power*, 19 COLO. J. INT'L ENVTL. L. & POL'Y 427, 436 (2008); Pursley & Wiseman, *supra* note 1, at 890 (discussing the growth in small wind projects in

desirable in terms of reducing greenhouse gas emissions, but it may also result in increased conflicts over the use of wind.[58] It may be hard to imagine today, but consider a scenario in which a turbine is positioned on every rooftop. The families living on the downwind side of the neighborhood or the city are likely to suffer from a drained wind current, and the effect could be reduced energy output for these downwind families, analogous to building too many dams on a river.

The urban locality could generate another type of wind-related conflict resulting from the obstruction of wind rather than its extraction. The production of energy from wind depends on unobstructed access to their source.[59] Therefore, constructing a particularly tall or wide building might prevent the wind stream from reaching houses in the downwind direction. While the building does not harvest wind as turbines do, it still changes the wind's course.[60] Since the course of the wind is altered, its availability for electricity production at a particular point downstream is reduced. In other words, there could be potential scarcity regarding the ability to access the resources, analogous to diverting water from a river or stream.[61]

As a result, while the residents of the tall building can enjoy

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the United States); AM. WIND ENERGY ASS'N, 2011 U.S. SMALL WIND TURBINE MARKET REPORT 4 (2011), http://awea.files.cms-plus.com/2011_AWEA_Small_Wind_Turbine_Market_Report.pdf. Based on average electricity consumption in 2013 [10,908 kWh per U.S. family], a 10 kW turbine could cover a family's full yearly consumption. *Frequently Asked Questions: How much electricity does an American home use?*, ENERGY INFORMATION ADMINISTRATION, http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3 ("In 2013, the average annual electricity consumption for a U.S. residential utility customer was 10,908 kilowatt hours (kWh)."); *See generally* DEP'T OF ENERGY, 2014 DISTRIBUTED WIND MARKET REPORT, http://www.energy.gov/sites/prod/files/2015/08/f25/2014-Distributed-Wind-Market-Report-8.7_0.pdf (discussing the growth trend in distributed wind generation).

58 *See supra* note 42 and accompanying text.

59 *See* Megan Hiorth, Note, *Are Traditional Property Rights Receding with Renewable Energy on the Horizon?*, 62 RUTGERS L. REV. 527, 528 (2010); *see also Wind Obstacles*, DANISH WIND INDUS. ASS'N, http://www.motiva.fi/myllarin_tuulivoima/windpower%20web/en/tour/wres/obst.htm (last updated June 1, 2003).

60 Yael Lifshitz Goldberg, Comment, *Gone with the Wind? The Potential Tragedy of the Common Wind*, 28 UCLA J. ENVTL. L. & POL'Y 435, 456 (2010) (noting that "wind can likewise be altered due to man-made barriers, such as buildings. . . . However, unlike buildings, wind turbines not only redirect and decelerate the wind, they harvest it").

61 *See* Klass, *supra* note 1, at 80.

the benefits of electricity produced from wind energy—or simply enjoy the cool breeze—the downwind homes have less energy potential and are forced to cool their houses using other means. This again may lead to conflicts over the changing winds. In sum, due to increased use of small wind turbines in neighboring localities and the complexities associated with wind obstruction resulting from urban construction, policy makers are likely to face the challenges of wind management in the urban settings as well.

B. *The Extraction of Energy Presents a Problem of Externalities*

Wind wakes can be seen as a problem of externalities. Absent any legal restrictions to the contrary,[62] a farmer utilizing wind resources to produce energy feels free to internalize the gains from the production of such energy, but she is not required to shoulder the burden caused by the depletion of the resource in the downwind direction.[63] Since wind users are entitled to enjoy the profits of their capture without internalizing the costs, each landowner has a strong incentive to continue using as much wind as possible, without considering the impact on others, inevitably harvesting more energy than is socially optimal.[64]

Similarly, the problem of externalities presents itself in the urban setting as well. Just like the farmer has an incentive to continue harvesting the wind, the building owner is encouraged to place too many turbines on her roof, or construct the tallest or widest building in the city, without paying for her impact on the wind.

While in some cases Coasean bargaining may be possible,[65] in

62 *See infra* Part II (discussing the existing wind rights and the ways in which they do or do not restrict harvesting the wind).

63 A lack of legal restrictions on the extraction of wind as such (as discussed in Part II) implies that no legal mechanism levies the cost of the downwind effects on those that harvest the wind resources.

64 *See* Lifshitz Goldberg, *supra* note 60, at 448 (discussing landowners' incentives to engage in wind energy production). Relying on wind energy reduces greenhouse gas emissions that would otherwise be produced by traditional fossil-fuel energies. In that sense, wind energy is always beneficial. However, maximizing social welfare involves a broader and more complex set of considerations. The greenhouse gas reductions are only part of the overall welfare analysis. This Note addresses that issue by arguing that we need to account for a broader range of interests when considering turbine siting and the use of wind in general.

65 *See generally* Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

most situations it is not likely to take place, due to the collective action problem.[66] Consider a situation in which a large wind farm is located upwind of a city, causing the families in the downwind location to receive a drained wind current. Assume also that, due to the lack of breeze, the families in the downwind neighborhood need to use artificial means to cool their homes. This phenomenon is no doubt familiar to anyone that has ever lived in a warm climate where the existence of a breeze can dramatically affect the costs of air-conditioning. In theory, if the aggregated cost of air-conditioning for all the downwind homes exceeds the benefits of the windfarm, the families suffering from a lack of wind could negotiate with the windfarm to stop its energy-producing operations. However, due to problems of collective action, the downwind families are less likely to do so.[67] This would also be true if the depleted breeze were to affect farmers' seed pollination rather than household costs. The result is that the landowner could in fact harvest the wind without accounting for either the costs incurred by neighbors or the ecological effects of the energy extraction.[68]

This situation is similar to the famous Tragedy of the Commons created by the addition of too many cattle to a common grazing field.[69] Admittedly, there are some differences between a grazing field and the wind: the grazing field cannot regrow if there are no seeds left in the area. Wind, however, is regenerated by differences in temperature created by the sun.[70] Thus the renewal

66 The term 'collective action' generally refers to the difficulties of a diffused group to organize and achieve a shared goal or manage a shared issue. Collective action has been the subject of rich scholarly debate. *See, e.g.*, MANCUR OLSON JR., THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 22, 32–36 (1965) (identifying the negative correlation between the number of participants in a collective enterprise and the likelihood of their success in advancing a shared goal given the increased transaction costs of identifying, organizing, and coordinating the large group); ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 183–84 (1990) (discussing how the size of the group implicates the likelihood of resolving the problem of collective action). For consideration of the Coasean roots of collective action problems, see Elizabeth Hoffman & Matthew L. Spitzer, *The Enduring Power of Coase*, 54 J.L. & ECON. S63, S64–S65 (2011).

67 *See supra* note 66 and accompanying text.

68 *See* Part I.A.

69 Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1244 (1968).

70 *See* AHRENS, *supra* note 6, at 203–05; New York State Energy Research and Development Authority, *supra* note 26 ("[T]he air moves in response to pressure differences, or gradients, between different parts of the earth's surface.

of wind does not depend on the existence of a minimum amount of wind being present.[71]

However, it is important to understand that in the short term and on a local scale, wind is not unlimited; it is exhaustible. Wind can regenerate over a certain distance, but until it recovers, it may be considerably slowed and, depending on the ground conditions, may never have the chance to regain its speed.[72] In practice, recovery distance might be the determining factor for whether a wind-use conflict arises.[73] Consider what would happen to the weather conditions or the pollination of seeds in the wake of a windfarm. Alternatively, consider a similar (but opposite) example given by Garrett Hardin, regarding the tragic tendency to create air pollution.[74] While we do not need a minimum amount of clean air to create the next batch of clean air, the fact that the cost of polluted air is shouldered by all, while most of the gains from producing are enjoyed by few, creates an unfortunate tendency to overuse our clean air resources. This may be true for our wind resources as well: just like the tendency to put too much into the air, there might be a tendency to extract too much out of the air.[75]

An air mass tends to move towards a zone of low pressure and away from a zone of high pressure."). These differences in pressure are created by solar heating. *Id.* ("[A]ir pressure gradients . . . are continually being powered by uneven solar heating of the earth's surface. When the surface heats up, the air above it expands and rises, and the pressure drops. When there is surface cooling, the opposite process occurs, and the pressure rises.").

71 Therefore, because the wind is recreated by differences in air temperature due to the sun, in theory, we could extract all the energy from the wind such that the air would be completely motionless, and new wind would eventually be created, as long as the sun continued to heat the earth.

72 *See supra* Part I.A.

73 This is because as the distance behind the turbine grows the effect of the wake decreases. Diamond & Crivella, *supra* note 35, at 204 ("The further away a downwind turbine is located from an upwind turbine, the less impact it experiences in terms of wake loss and wind velocity deficit from the upwind turbine.").

74 Hardin, *supra* note 66, at 1245. As opposed to the grazing example, with pollution the tragic tendency is not to over-extract something from the common resource (e.g. too much grazing), but rather excessive addition of something into the commons. But just like in the grazing example, each user benefits from each additional unit (in this case, of pollution) while shouldering only a fraction of the overall cost of pollution. Since this is true for all users, we see the tragic tendency to over-pollute. *Id.*

75 For further discussion, *see also* Lifshitz Goldberg, *supra* note 60 (discussing the wind as a common resource which could potentially be subject to the commons dilemma).

In contrast, altering wind currents could also create positive externalities; in some locations, depleting or obstructing the wind decreases the costs incurred by residents in, for example, heating their homes. In cities, creating wind tunnels might actually enhance the ability of some to produce wind-based electricity.[76] However, this may also create conflicts over the use of wind, as potential users vie for access to the tunnels. The point is that constructing a building that changes the winds—whether by extraction or obstruction—will be beneficial to some and disadvantageous to others. Either way, the agent deciding to erect a turbine or construct a building is not seeing the full impact of her actions, whether positive or negative.

At the same time, the lack of clear wind-use rules could cause underinvestment in the development of wind-resources.[77] At present, because of the uncertainties associated with the uncontrolled use of wind, developers are concerned about their ability to gain returns on their investments.[78] This is true both for upwind and downwind developers. The downwind developer may worry that her upwind neighbor could diminish the wind available to her. Once the turbines or buildings are constructed upwind, her access to wind could be reduced, hindering her ability to produce electricity and earn a return on her investment.[79] The upwind developer may also be worried that a downwind developer might sue for the diminished kinetic energy. At present, due to the uncertainties associated with the uncontrolled use of wind, the upwind developer may fear that the risk of costly litigation is too great and prefer not to invest in the turbines at all.[80] The result is that, given the risks currently involved for both downwind and upwind developers, they might each end up foregoing an opportunity to produce energy from the wind. Thus, the fact that

76 *See, e.g.*, B. Blocken, T. Stathopoulos & J. Carmeliet, *Wind Environmental Conditions in Passages Between Two Long Narrow Perpendicular Buildings*, 21 J. AEROSPACE ENG'G 280 (2008), http://sts.bwk.tue.nl/UrbanPhysics/pdf/ASCE_BB_TS_JC_PREPRINT.pdf (noting that "passages between buildings can be responsible for increased wind speed").

77 In fact, over-use and under-use can be seen as two sides of the same coin, or symmetrical tragedies. Thomas W. Hazlett, *Spectrum Tragedies*, 22 YALE J. ON REG. 242, 245 (2005).

78 *See, e.g.*, Rule, *supra* note 42, at 210 (discussing specifically the uncertainties due to potential profit loss through lawsuits).

79 *Id.*

80 *Id.*

potential investors cannot keep other users from preempting their energy-producing activities might result in under-investment in the capture of wind energy.

C. *Wind Energy is Growing Rapidly*

The complexities described above become all the more pressing given recent growth in wind energy production. To illustrate, in 2000 the overall installed (utility scale) capacity of wind production in the United States was about 2500 MW.[81] By 2013, the United States had 61,110MW of installed wind capacity,[82] which accounts for 4.1 percent of the of total U.S. electricity supply.[83] In fourteen years, the installed capacity increased by nearly twenty-five times. And further growth can be expected. The U.S. Department of Energy estimates that by 2030 the United States could generate 20 percent of its electricity from wind power.[84] More generally, in light of the geopolitical complexities in oil-rich areas and the challenges of climate change, the growth of wind power is likely to continue into the future. This expected growth increases the management challenges that policymakers are likely to face.

II. A SNAPSHOT OF THE MECHANISM GOVERNING THE USE OF WIND AT PRESENT

Despite the apparent importance of wind energy production and, accordingly, the allocation of wind rights, there is a lack of comprehensive legislative and judiciary guidance on this issue at present. Lack of guidance as to the existing rights could lead to wasteful practices or suboptimal investment in resource

81 20% Wind Energy by 2030, *supra* note 2. According to the NREL maps, in 1999, the overall installed capacity in the US was 2,472 MW. U.S. DEP'T OF ENERGY, Wind and Water Program: WINDExchange, http://www.windpoweringamerica.gov/wind_installed_capacity.asp.

82 INT'L ENERGY AGENCY, IEA WIND 2013 ANNUAL REPORT 5 TABLE 2 (Aug. 2014), http://www.ieawind.org/annual_reports_PDF/2013/2013%20AR_small_090114.pdf.

83 *Id.*

84 20% Wind Energy by 2030, *supra* note 2. *See* U.S. Dep't of Energy, *Wind Vision*, supra note 4, at 22 (discussing the wind energy potential in the United States, noting that there are over "15,000 GW of technical wind resource potential, both land-based and offshore, that can be harnessed and delivered reliably").

development.[85] Therefore, it is imperative to closely examine existing wind rights.

To clarify, this paper uses the terms 'property interests in wind' or 'wind rights' to refer to a broad definition of property interests, including a wide scope of wind-use rights created by the courts, or by legislative or administrative institutions. This Note does not aim to address other mechanisms that are sometime employed with regards to wind energy production, such as tax credits, loans, or renewable energy portfolios.[86] These mechanisms are government subsidies that provide generalized financial or legal incentives to invest in renewable wind energy projects. In comparison, the term 'wind rights' as used here refers to the specific, inherent rights that one could have with respect to the wind as it passes by. This includes, but is not limited to, the extraction of the kinetic energy locked within the wind. The inquiry into wind rights is primarily concerned with identifying the emerging property regimes that have taken on a specific wind aspect, such that they have created or recognized a specific right to use the airborne kinetic energy. Thus, a wind right is one that has specifically stated what the individuals' rights and obligations are regarding the use of the airborne kinetic energy.[87]

Indeed, in several instances such interests in the wind itself have been recognized by the legislature, the judiciary, and by landowners themselves. The following section will briefly discuss existing wind rights that recognize an individual's interests in the flowing of air over her land. The analysis will proceed as follows: first, the discussion will focus on the different forms of legislative recognition of property interests in wind itself. It will then turn to

85 *See supra* Part I.B for discussion regarding underinvestment.

86 For a review of some of these mechanisms currently in place, see Smith & Diffen, *supra* note 19, at 167–76 (2010); Klass, *supra* note 1, at 95–96.

87 In that sense, it does not matter how we define the 'baseline.' What matters is that we recognize a departure from the previous state of kinetic energy in the wind. Such a definition also has the advantage of focusing solely on the energy element of the wind. At the same time, it avoids the need to identify a baseline, which could be a problematic issue in itself. Specifically, there can be multiple relevant and applicable 'baselines,' including the notion of *ad coelum* or analogies to other natural resources, such as oil and gas, wildlife, and sunlight. *See supra* note 25. Each of these options has some advantages, although applying each regime may produce different outcomes. The main point is that, absent a specific recognition of one baseline or the other, it is impossible to determine which one of these regimes would apply. The 'baseline,' in so far as it exists, is not clear at present.

highlight some of the cases of judicial recognition of wind rights and will discuss wind rights on federal lands. Lastly, the discussion will briefly note the existence of wind leases which could attest to a de facto existence of property interests in wind.

The legislative recognition of wind rights takes on different forms. In some cases, it is explicit. Perhaps the most explicit potential legislative expression of a property right in wind can be found in Colorado, which introduced a bill providing that "the wind interest" is "the right to use, convert, maintain, and capture the flow of wind currents."[88] If this bill were enacted, Coloradoans could assert a strong, explicit ownership right. Legislation has also addressed the lease of wind rights; a few states have explicitly acknowledged the ability to lease the right to use airborne kinetic energy in the wind. Montana,[89] South Dakota,[90] Nebraska,[91] and Kansas[92] recognize the practice of wind leasing via statute, although such a practice is not formally endorsed in most states.

In several other instances, the legislative recognition of wind rights is less explicit. In such cases, the application of property rights to the wind resources often relies on existing common law property mechanisms. For instance, property rights in the wind sometimes take the form of easements, such that a farmer holding a wind easement can ensure continued and unobstructed access to the resource. Wind easements protect, for example, the property owner's ability to install a wind turbine without worrying about a tall building being constructed in the upwind direction that could block her wind. By doing so, the easements can ensure the viability of investment in the development of wind energy production or simply preserve the continuous flow of air for purposes of cooling her home. Such easements would be

88 H.R. 1158 §3(3), 2010 Gen. Assemb. (Colo. 2010). The wind interest is initially the property of the surface owners and "is a property right that can be severed from the surface ownership." *Id.*; *see also* Smith & Diffen, *supra* note 19, at 177 (discussing the Colorado bill).

89 Although the "wind energy agreement" is recognized in conjunction with a wind-easement. MONT. CODE ANN. § 70-17-402 (2011).

90 S.D. CODIFIED LAWS §§ 43-13-16 to -19 (2004 & Supp. 2009) (although the right can only be established by lease for no longer than 50 years and a lease of wind energy rights automatically terminates at the end of five years if no development has occurred). *See also* Diamond & Crivella, *supra* note 35, at 239–41 (discussing the bill).

91 NEB. REV. STAT. § 66-909.04 (2011) (defining a "wind agreement" as a "right . . . securing land for the study or production of wind-generated energy.").

92 KAN. STAT. ANN. § 58-2272 (2005).

analogous to the traditional common law easements for light and air.[93] Wind easements, however, are currently only endorsed by legislation in a few states. Oregon provides that a "wind energy easement" is "any easement, covenant or condition designed to insure the undisturbed flow of wind across the real property of another."[94] Similar easements also exist in Montana,[95] South Dakota,[96] North Dakota,[97] Nebraska,[98] Kansas,[99] Minnesota,[100] and Wisconsin[101] with slight variations.

Other mechanisms that are occasionally used to protect the interest in the flowing of wind on one's land are zoning and siting systems. The siting systems provide for wind protection by defining 'setback' or 'wind access buffer' provisions, which protect the interest in free-flowing wind by prohibiting turbine installation within a certain distance of property borders. This can assure that the neighboring properties will not receive a depleted wind current, since the setback provides a recovery distance after

93 *See* Smith & Diffen, *supra* note 19, at 186.

94 OR. REV. STAT. § 105.900.

95 Defining an easement as "the right granted by the owner of real property . . . guaranteeing the developer the right to use the real property legally described in a wind energy agreement and the wind resource located on and flowing over its surface" (MONT. CODE ANN. § 70-17-402 (2011)).

96 Defining a wind easement as "a right, whether or not stated in the form of a restriction, easement, covenant, or condition . . . for the purpose of ensuring adequate exposure of a wind power system to the winds" S.D. CODIFIED LAWS § 43-13-16 to -19 (2004 & Supp. 2009). Although such easements are limited to a term of no more than fifty years, and are void "if no development of the potential to produce energy from wind power' occurs on the benefited land within five years of the grant of the easement." *Id.*

97 *See* N.D. CENT. CODE§§ 17-04-02 to -03 (2009) (similar to South Dakota, the easement is also void if substantial steps towards an operable wind farm on the benefited land have not been taken within five years of granting the easement) ; *see also* Smith & Diffen, *supra* note19, at 187.

98 *See* NEB. REV. STAT. § 66-909.04 (2012) ("[W]ind energy easement shall mean any easement, covenant or condition designed to insure the undisturbed flow of wind across the real property of another."); s*ee also* Klass, *supra* note 1, at 102–03.

99 *See* KAN. REV. STAT. ANN. § 58-2272 (2005).

100 MINN. STAT. § 500.30 (2010) (providing that a "'wind easement' means a right . . . executed by or on behalf of any owner of land or air space for the purpose of ensuring adequate exposure of a wind power system to the winds").

101 WIS. STAT. § 700.35 (providing for a "renewable energy resource easement," which "limits the height or location, or both, of permissible development on the burdened land in terms of a structure or vegetation, or both, for the purpose of providing access for the benefited land to wind or sunlight passing over the burdened land").

the wind hits the turbine. Such a setback provision has been adopted in Minnesota, which stipulates a "wind access buffer"[102] explicitly intended to "protect wind rights and future development options of adjacent rights owners."[103] Setback provisions for wind installations have also been adopted at the local level by several counties.[104]

In several instances courts have recognized wind as a severable interest, separate from the ownership of the land itself. In the earliest case discussing the existence of wind rights, *Choctaw, Oklahoma & Texas Railroad Co. v. True*,[105] the Court of Civil Appeals of Texas implicitly recognizes wind rights.[106] The plaintiffs sought damages for the construction of an embankment adjacent to their property.[107] Evidence of the embankment's interference with plaintiff's ability to use the windmill was found to be relevant to demonstrating damages.[108] Although the court did not explicitly discuss wind rights, the fact that such interests were acknowledged and separately protected suggests a de facto recognition of wind rights and their value.[109]

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102 Providing that turbines cannot be built within a certain distance from "the adjacent property border." *See* Order Establishing General Wind Permit Standards, *supra* note 52.

103 *Id.* It is also meant "to protect the wind and property rights of persons outside the permitted project boundary and persons within the project boundary who are not participating in the project." *Id.* This setback also applies to State lands. *Id.*

104 The U.S. Dep't of Energy offers a catalogue of wind energy ordinances, totaling 381 as of October 2015. *See* U.S. Dep't of Energy, Energy Efficiency & Renewable Energy, *Wind Energy Ordinances*, http://apps2.eere.energy.gov/wind/windexchange/policy/ordinances.asp#links. For example, in Monterey County California, the ordinance controlling the installation of "wind energy conversion systems" stipulates that they "shall maintain a minimum setback of two times the total height of the Wind Energy Conversion System from any property line." MONTEREY COUNTY, CAL. ZONING ORDINANCE 21, 21.64.120, §2(a). And as mentioned, similar provisions exist in many other counties across the US. Yet it is not unclear whether they are indeed intended to protect the free flowing wind or rather they are concerned with protecting other interests such as noise, and view.

105 Choctaw, Okla. & Tex. R. Co. v. True, 80 S.W. 120 (Tex. Civ. App. 1904).

106 Thaddeus Baria, Comment, *Up the Creek with a Paddle: Water Doctrine as a Basis for Small Wind Energy Resource Rights*, 59 DEPAUL L. REV. 141, 153 (2009) (discussing the case).

107 *Id.* (citing *True*, 80 S.W. at 121).

108 *Id.* (citing *True*, 80 S.W. at 121).

109 *See id.*

Later cases have recognized a more explicit right to the wind over one's land. In *Contra Costa Water Dist. v. Vaquero Farms, Inc.*,[110] the California Court of Appeal (First District) recognized wind as an explicit severable property interest. The case involved a taking of land on which wind power facilities were installed. The court was called upon to consider the following question: "When a public entity acquires property through eminent domain, are the windpower rights capable of segregation or are they so affixed to the underlying land that they must be acquired by the condemning authority?"[111] The court found that "windpower rights are 'substantial rights' capable of being bought and sold in the marketplace,"[112] holding that these rights where much like rights in other energy-producing minerals, such as oil and gas.[113] The court therefore recognized a right to the flow of wind, separate from the right to the land itself.

Although the *Contra Costa* holding could be seen as limited to eminent domain proceedings,[114] subsequent case law suggests that other courts have taken a similar understanding regarding interests in wind. In 2009, the question of wind rights was addressed by the U.S. District Court for the District of New Mexico in *Romero v. Bernell*.[115] The respondent, opposing the partitioning of a parcel of land owned by tenants in common, "argued that the land could not be partitioned" because the main "value of the land was in wind farm development," and partitioning the land would diminish that value.[116] Instead of drawing an analogy to minerals, the *Romero* court compared water with wind as a severable property interest.[117] However, the court

110 Dist. v. Vaquero Farms, 58 Cal. App. 4th 883, 68 Cal. Rptr. 2d 272 (1997).

111 *Id.* at 276.

112 *Id.* at 277.

113 *Id.* at 278 (agreeing with the Water District that "[t]he right to generate electricity from windmills harnessing the wind . . . is no different, either in law or common sense, from the right to pump and sell subsurface oil, or subsurface natural gas").

114 *See* Smith & Diffen, *supra* note 19, at 177; Alexander, *supra* note 2, at 453.

115 Romero v. Bernell, 603 F. Supp. 2d 1333, 1334–36 (D.N.M. 2009).

116 Alexander, *supra* note 2, at 453 (citing *Romero*, 603 F. Supp. 2d. at 1334). The respondent further argued that "wind power rights, like mineral rights, are not capable of being partitioned." Alexander, *supra* note 2, at 453 (quoting *Romero*, 603 F. Supp. 2d at 1334) (internal quotation marks omitted).

117 *Romero*, 603 F. Supp. 2d. at 1334–35; Alexander, *supra* note 2, at 453; *see*

limited the wind right only to cases where the wind has actually been captured.[118] The court found that "[t]he right to 'harvest' wind energy is . . . an inchoate interest in the land which does not become 'vested' until reduced to 'possession' by employing it for a useful purpose."[119] In this case, since there were no actual wind turbines on the property, the court found that the wind interest had not yet materialized and ordered the division of the property.[120] In other words, the *Romero* court recognizes severable wind rights, though such rights only materialize when the wind is captured for a "useful" or "beneficial purpose."[121]

Despite these promising cases, there is otherwise very little jurisprudence on the severability of wind rights. The few adjudicated cases that pertain to wind energy installations are typically concerned with the noise or aesthetics of the turbines, or even the wellbeing of the wildlife in the region, but are mostly not concerned with the extraction of the kinetic energy itself as a separate protectable interest.[122]

In addition to wind rights at the state level, there is also an interesting example regarding the right to use wind blowing over federal lands. The BLM "manages 20.6 million acres of public lands" that are blessed with wind-energy potential.[123] Yet the agency does not install turbines nor harvest the wind itself. Rather,

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also Alexander, *supra* note 2, at 453 n.193 ("New Mexico applies prior appropriation to both its surface water and its groundwater, and an interest in groundwater is severable.").

118 Alexander, *supra* note 2, at 453.

119 *Romero*, 603 F. Supp. 2d at 1335.

120 Alexander, *supra* note 2, at 453 (citing *Romero*, 603 F. Supp. 2d at 1335–36).

121 *Romero,* 603 F. Supp. 2d at 1335–36; *see also* Alexander, *supra* note 2, at 453 (discussing the Romero case). Interestingly, this holding could arguably be influenced by the court's understanding of wind as similar to water appropriative water rights, as discussed below.

122 *See, e.g.*, Rankin v. FPL Energy L.L.C., 266 S.W.3d 506 (Tex. App. 2008) (rejecting nuisance suit filed by neighbors of a proposed wind farm that were concerned with loss of view and noise); Finger Lakes Pres. Ass'n v. Town Bd. of Italy, 887 N.Y.S.2d 499 (Sup. Ct. 2009) (dismissing residents' claims pertaining to the siting process and the noise created by the turbines); Ctr. for Biological Diversity, Inc. v. FPL Grp., Inc., 83 Cal. Rptr. 3d 588 (Ct. App. 2008) (rejecting environmental group complaints regarding impacts on birds); *see also* Klass, *supra* note 1, at 106–07 (discussing further cases that demonstrate this).

123 U.S. Department of the Interior Bureau of Land Management, BLM Fact Sheet=Renewable Energy: Wind (2015), http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTIO N_/energy.Par.22758.File.dat/Wind_06_2012.pdf.

it provides private contractors with rights of way to do so, which are essentially permits to extract wind for energy production purposes at a given location, under certain restraints.[124]

Interestingly, the right of way also includes a setback requirement stipulating a minimum distance that a turbine must be located from the boundary "in the dominant upwind or downwind direction" and specifically states that this setback aims "to avoid potential wind turbulence interference issues with adjacent wind energy facilities."[125] Thus, the BLM rights of way specifically account for the wind wake effects, and establish a setback requirement to avoid such interferences and the potential harm to downwind right-holders.

Lastly, another factor that could attest to the existence of wind rights is the de facto treatment of wind as a protectable interest in the contracts landowners are making with developers to lease the use of their wind. These contracts typically do not aim to transfer ownership of the entire property,[126] but rather aim only to facilitate

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124 All rights of way, whether for testing or energy production, are subject to a fee as stipulated by the BLM. Authorization under the right of way applies to the right to extract wind for energy production and extends to the development of all facilities which are related to the production of wind energy, such as the turbines and electric distribution facilities. INSTRUCTION MEMORANDUM NO. 2009-043, WIND ENERGY DEVELOPMENT POLICY, BUREAU OF LAND MANAGEMENT U.S. DEPT. OF THE INTERIOR (2008), http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2009/IM_2009-043.html. Certain aspects of the rights-of-way application process are currently under review. The BLM has published a proposed rule that amends the procedures for the entering into leases and the incentives to install in specific areas ('designated leasing areas'). Competitive Processes, Terms, and Conditions for Leasing Public Lands for Solar and Wind Energy Development and Technical Changes and Corrections, 79 Fed. Reg. 189 (Sept. 30, 2014).

125 *See* Instruction Memorandum, *supra* note 124 at [part 3 titled "Development Grant"]. There are two exceptions to this limitation. First, "unless it can be demonstrated that site conditions, such as topography, natural features, or other conditions such as offsets of turbine locations, warrant a lesser distance." *Id.* at part 3 (titled "Development Grant"). Second, "[i]n cases where the applicant holds a long-term lease right on adjacent Federal or non-Federal lands for wind energy development or the adjacent non-Federal landowner provides a setback waiver." *Id.* The setback requirement was not amended by the recent rulemaking. E-mail from Ray A. Brady, BLM Renewable Energy Policy Team, Jun. 23, 2015, 2:38PM PST (on file with author) ("[T]he setbacks are still in place by policy guidance. They will not be established by regulation as they may change overtime, but will be carried forward in policy guidance.").

126 *See, e.g.*, ERNEST E. SMITH ET AL., TEXAS WIND LAW § 3.02 (2013) ("[L]andowners executing wind leases often include provisions expressly reserving their rights to use the land for other uses, such as farming, ranching, oil

the extraction of wind for energy production,[127] thus asserting a de facto property interest therein. It is nearly impossible to precisely determine the popularity of such wind leases, yet several practitioners have written about the widespread phenomenon of wind leasing,[128] and industry representatives have also attested to the widespread popularity of these leasing practices in recent interviews.[129]

Looking at the current wind rights (or lack thereof), whether established through the legislative or judicial systems, it becomes apparent that the rights to use the energy locked in the wind have

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and gas exploration, and hunting.").

127 *See, e.g.*, Gregory S. Friend, *A Tale of Two Uses: Landowner Perspectives on Wind Leasing and Transmission Easements* (conference presentation at Wind, Solar and Renewables Fundamentals conference, sponsored by the University of Texas School of Law, 7–8 (2010), http://www.sbaustinlaw.com/library-papers/Friend_WE10_paper.pdf (noting that wind leases often list specifically the activities a developer may engage in, which include access the property, free flow of wind over the property, install transmission lines and conduct studies, and that the landowner "generally . . . possess[es] the rights to utilize the property in the manner it had been used previously, so long as that activity does not interfere with the rights granted to the developer"); WINDUSTRY, WIND ENERGY EASEMENT AND LEASE AGREEMENTS 6–7 (2005), http://www.windustry.org/sites/windustry.org/files/LandEMain.pdf (discussing rights typically given to developers under wind leases and rights reserved for landowners); *see generally* LISA CHAVARRIA, THE SEVERANCE OF WIND RIGHTS IN TEXAS (2008), http://sbaustinlaw.com/library-papers/Chavarria-The_Severance_of_Wind_Rights%20%28Final%29.pdf. For instance, a Texas treatise on Wind Law proposes a model wind-lease agreement which suggests that the purpose of the lease be defined as "solely and exclusively for wind energy purposes, and not for any other purpose." SMITH ET AL., *supra* note 126, at app. 2. In addition, under the proposed model agreement, the "landowner reserves the right to use the Property for any purpose (including but not limited to agricultural, ranching, hunting, and oil and gas development)." *Id.* at § 3.02. The perpetual aspect of the wind lease is another indication of the strong property notion that these agreements take on. *See id.* at § 3.02 (noting that typically "any subsequent lessee of land subject to a wind lease takes subject to the wind lease").

128 This is especially true in areas where the production of wind energy is prevalent, such as Texas. *See, e.g.*, Alexander, *supra* note 2, at 440–41 (noting that severance of wind rights through leases has become "common practice"); Chavarria, *supra* note 127, at 2. Interestingly, practitioners also note that, although in several instances contractual disputes over various issues within the wind leases have come before the courts, to date, the validity of the wind leases themselves has not been questioned neither by the parties to the dispute nor by the courts. *Id.*

129 Telephone Interview with Randy Sowell, Manager Fremantle Energy LLC (Sept. 27, 2012); Telephone Interview with Joe Sullivan, Regional Policy Manager, West (Oct. 2, 2012).

yet to be fully developed. As this Note illustrates through the review of current wind rights, the governance of wind resources is still underdeveloped. It is, therefore, imperative to further examine the question of how we should manage wind. One way to answer this question is by employing an analogy to a similarly fugitive and stream-like asset: water.

III. WHY COMPARE TO WATER?

Wind and water are similar in many ways, especially in their flowing, stream-like behavior. Both these assets flow along (mostly) defined routes, such as canyons and creeks, or the prevailing wind patterns. They each have a unique role in the ecosystem: they assist reproduction by carrying seeds and other organisms on their way; their force assists fish and birds in travelling across great distances; and they slowly shape the landscape by carrying along trees, soil, and rocks. Furthermore, both resources are blessed with the potential to produce electricity by converting the kinetic energy locked in the stream into electric energy.[130] Lastly, the kinetic energy in both resources is renewable: the movement of air is recreated over and over by the recurring differences in air pressure,[131] and the water cycle will continue given the repeated rain patterns.[132] Accordingly, wake-

130 Interestingly, a similar analogy between wind and water was also drawn by the District Court for the District of New Mexico, which found that wind, as compared to minerals, is not found in a set place, but rather is more analogous to flowing water. *See* Romero v. Bernell, 603 F. Supp. 2d 1333, 1334–35 (D.N.M. 2009) (comparing the right to extract wind energy to the right to appropriate surface water and groundwater under New Mexico's prior appropriation regime); *see also supra* Part II.

131 *See supra* notes 26–28 and accompanying text.

132 Note the distinction between the renewability of the kinetic energy and the availability of clean resources. The latter refers to either clean air or clean water (for example drinking water). The fact that kinetic energy in either water or wind is renewable does not mean that the clean water or clean air supplies are also replenishable. Also note that, while the total water supply on earth is renewable, specific bodies of water may not be. For example, if you over-extract an aquifer beyond the annual safe yield, it will be depleted. For a basic explanation of the earth's water cycle *see* THE WATER CYCLE, U.S. GEOLOGICAL SURVEY, http://ga.water.usgs.gov/edu/watercycle.html (last visited Sept. 21, 2015); *The Water Cycle*, NAT'L AERONAUTICS SPACE ADMIN., http://aquarius.umaine.edu/cgi/gal_movies.htm?id=69&type=ed (last visited Sept. 21, 2015). For an assessment of the renewable fresh water on earth *see* The World Bank, *Renewable Internal Freshwater Resources Per Capita*, WORLDBANK.ORG, http://data.worldbank.org/indicator/ER.H2O.INTR.PC/countries/1W?display=ma

related problems—which are the focus of this paper—appear in both resources in a similar manner: an upstream user creates a wake that detracts the amount of kinetic energy available to downstream users. In the case of water, this may be due to a dam on a river; with regards to wind, it could be from a turbine or a building.

Moreover, both resources are essentially common pool resources. Such resources are non-excludable (or excludable at a prohibitively high cost), yet are "rivalrous" in the sense that the use of one can diminish the potential use by others.[133] Excluding users from accessing a large river or lake is difficult, making the water essentially non-excludable. The use of these bodies of water, for purposes such as irrigation or industry, causes other users to have less water available, making water rivalrous as well.[134] Similarly, as discussed above, it is hard to exclude users from enjoying a breeze, yet the wind is diminished when it is harvested for its energy such that its use by one decreases the amount of wind available for others. Taken together, both wind and water are relatively hard to fence and difficult to control, yet the extraction of parts of the resource leave less available for others.

Since both wind and water are common pool resources, they face some of the same problems regarding shared resource management and property allocation. For instance, common pool resources are typically subject to problems of overuse.[135] Thus, exploring the lessons learned from governing the common waters

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p(last visited Jan. 21, 2014).

133 Eric A. Posner & Alan O. Sykes, *Economic Foundations of the Law of the Sea*, 104 AM. J. INT'L L. 569, 571 (2010) ("[a] common pool resource has two defining characteristics: no single actor has established control over it; and the consumption of the resource is to some degree 'rivalrous,' meaning that when one actor consumes the resource, its quantity or quality is diminished for other potential consumers") (citations omitted); *see generally* ELINOR OSTROM ET AL., RULES, GAMES, AND COMMON-POOL RESOURCES (1994).

134 *See* Joseph W. Dellapenna, *Global Climate Disruption and Water Law Reform*, 15 WIDENER. L. REV. 409, 419 (2010) (discussing rivalrous goods).

135 *See generally* COMMON PROPERTY RESOURCES: ECOLOGY AND COMMUNITY-BASED SUSTAINABLE DEVELOPMENT (Fikret Berkes ed., 1989) (outlining the challenges of common resource management); ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990) (discussing common resource management); Martin S. Weinstein, *Pieces of the Puzzle: Solutions for Community-Based Fisheries Management from Native Canadians, Japanese Cooperatives, and Common Property Researchers*, 12 GEO. INT'L ENVTL. L. REV. 376 (2000) (discussing community based management).

might be beneficial in the efforts to tailor a regime to govern the common winds.

Furthermore, the term 'wind rights' as used in this paper, refers to the use of the wind as it passes by, including the extraction of the kinetic energy locked within it. The term is thus similar to water rights in the sense that it does not provide the owner with possession over the resource itself, but rather the right to use or extract the resources for her benefit. The similar nature of the property interests in wind and water thus provides another reason for looking at water regimes in the efforts to shape wind law.

Admittedly there are some differences between water and wind. Notably, water is crucial for human survival. While the movement of air is immensely important to the ecosystem as a whole, air movement is not necessary for human survival in the narrow sense.[136] This difference may influence the way in which we perceive and manage the resources. Moreover, water is used for a wider range of purposes than wind. Water uses range from domestic needs and recreation, to agricultural irrigation and industrial purposes, to energy production. Given this diversity of uses, conflicts over water are more likely to arise. Significant conflicts can arise simply from two industrial installations drawing water for production purposes from the same stream, two farmers using water for their crops, or a city relying on a river for drinking water.[137] Put differently, the wide range of uses, coupled with the necessity of water for human survival, makes the conflicts over the use of water resources more likely and more frequent.

Wind is not currently employed for such a wide range of uses. However, as previously discussed, wind does play an important role in our lives in many ways that may not be visible to us. Wind is used for several important purposes, such as electricity production, cooling homes, seed pollination, and kite-flying.[138] All

136 Naturally some elements of the air, namely oxygen, are essential for human survival, but the movement of air itself, i.e., wind, is not necessary for human survival.

137 See, for instance, the cases and examples discussed below in Part IV, which demonstrate the conflicts between competing users, as they attempt to harness water for industrial, domestic, agricultural, or energy production purposes.

138 Recreational activity is important and could sometimes be prioritized over other uses. Following the analogy to water, imagine preserving the water flow in the river to allow for boating, swimming, kayaking and more. A similar

these activities eventually compete with each other for wind use. Therefore, while the frequency of the conflicts over resources may differ, the fact that such conflicts over competing uses arise in both resources is enough to suggest that analogizing between the two could be fruitful.

Lastly, employing the analogy to water is not meant in any way to suggest that water regimes should be adopted "as is" to govern wind. The analogy merely serves as an analytical tool, helping us examine various ways to protect and govern wind. The maturity of water law in the U.S. provides an opportunity to choose from a menu of options, browsing the different regimes and considering whether they may be applicable to wind. Therefore, although wind and water no doubt exhibit some distinct physical differences, they are also similar in many ways that can be relevant to the analysis of property interests, including their stream-like behavior, their fugitive fluid nature, their ecological importance, and their properties as common pool resources. Drawing comparisons from the well-developed water law in the United States could thus produce particularly helpful lessons in crafting wind law.

IV. DRAWING ON WATER REGIMES TO CRAFT WIND LAW

Absent transaction costs, the Coase theorem stipulates that the initial allocation of wind rights will not change the final outcome, as parties will voluntarily enter into efficient transactions.[139] However, because current law causes great uncertainties regarding the allocation of interests in wind, and because of strategic behavior, problems of collective action, information asymmetries, and other transaction costs, Coasean bargaining is not likely to take place.[140] The allocation of wind resources and their governance will therefore impact the sum of wind available for energy production[141] and the costs of the regime, as well as the potential overuse of common resources. Similarly, property relations between individuals will impact the ways in which the

reasoning could apply to wind.

139 *See generally* Coase, *supra* note 65; *see also* ROBERT COOTER & THOMAS ULEN, LAW & ECONOMICS 82–87 (3rd ed., 2000).

140 *See, e.g.*, Christine Jolls, et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1476 (1998).

141 The availability for energy production is impacted by where the turbines are sited, as discussed in Part I above.

resource is used.[142] Examining interests in wind through the lens of analogous water law regimes is thus particularly interesting.

The creation of water law and the allocation of rights to use water in the U.S. are traditionally governed by state law.[143] Varying conditions and communities in different geographic regions birthed several vastly different approaches to water allocation rights.[144] The following analysis will survey four water regimes that have developed in the United States. Each one of these regimes is a world of its own, embodying nuances and intricacies that exceed the scope of this Note. The following analysis will portray the water regimes in broad strokes, outlining only the key structures of each regime to enable assessment of its overall applicability to the wind regimes. The analysis will attempt to determine their relative merits and their suitability to facilitate efficient development of the wind.

A. *Riparianism*

1. *Riparian Water Regimes*

A riparian regime provides for the allocation of water depending on land ownership and the reasonable purpose for which the water is used. It is based on the notion that the right to use the water on the property is a natural attribute of land.[145] Such land—adjoining or underlying water—is known as "riparian land."[146]

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142 *See* Dellapenna, *supra* note 134, at 420.

143 However, some scholars have argued recently that water law has, and should be, shifted more to the federal realm. *See, e.g.*, Robert W. Adler, *Climate Change and the Hegemony of State Water Law*, 29 STAN. ENVTL. L.J. 1 (2010) (arguing that due to the expected water shortages and related challenges the US is likely to face as a result of climate change, water law should be moved more into the federal jurisdiction). *See generally* David H. Getches, *The Metamorphosis of Western Water Policy: Have Federal Laws and Local Decisions Eclipsed The States' Role?*, 20 STAN. ENVTL. L.J. 5 (2001) (discussing changes in Federal involvement in water law).

144 *See infra* Part IV.A (discussing the adoption of riparianism in eastern states); *see also infra* Part IV.B (discussing the prior appropriation regime in western states).

145 *See* DAVID H. GETCHES, WATER LAW IN A NUTSHELL 16 (4th ed. 2009).

146 The Restatement Second of Torts defines riparian land as a "tract of land that borders on a watercourse or lake." RESTATEMENT (SECOND) OF TORTS §843 (AM. LAW INST. 1979). The restatement further explains that the significance of the riparian land is that "a person in possession of the land has certain rights and privileges in relation to the water that other persons do not have or do not have to

Riparianism is often seen as analogous to a community property right, in the sense that only insiders to that community, "co-owners," can access the resources, whereas outsiders are excluded from using the resource.[147] As co-owners, community members can decide if "and how to use the resource."[148] The protection of rights under this system typically involves adjudication in which the court examines the co-owners' decision to use the water and its impact on other members of the same community.[149]

Riparianism developed mostly in the eastern states in the United States, where people considered water resources to be readily available and where generally there was little or no water shortage.[150] Today, about half of the eastern states continue to rely on a traditional riparian regime to allocate the waters within the state among users.[151]

As mentioned, allocating water through a riparian system means that landowners adjacent to a body of water have a right to reasonably use the waters. The "reasonable use rule" adopted by the courts allows each riparian landowner to use water as long as her use does not violate the rights of other similarly positioned riparian landowners.[152] A central question in applying riparian

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the same extent." *Id.* Dellapenna, *supra* note134, at 421. *See also* Tyler v. Wilkinson, 24 F. Cas. 472, 474 (C.C.D.R.I. 1827) (No. 14,312) (stating that "the natural stream . . . is an incident annexed, by operation of law, to the island itself"). This opinion is often cited as the first riparian case. *Id.* For a more contemporary expression of the notion that riparian rights are a natural attribute of the land bordering a watercourse, see Niagara Mohawk Power Corp. v. Cutler, 492 N.Y.S.2d 137, 139–40 (App. Div. 1985), *aff'd mem.*, 492 N.E.2d 398 (N.Y. 1986); *see also* GETCHES, *supra* note 145, at 24–30 (discussing what constitutes riparian land and the different types of riparian lands such as lakes, streams, artificial watercourses and underground watercourses); *see also id.*, at 30–35 (discussing, for example, whether riparian rights can attach to as lands outside the watershed).

147 *See* Dellapenna, *supra* note 134, at 423.

148 *Id.* (noting that the case of Harris v. Brooks, 283 S.W.2d 129 (Ark. 1955) is illustrative of this).

149 *Id.* at 423–25 (discussing examples of adjudicating riparian rights).

150 *Id.* at 413–14.

151 *See infra* Part IV.C (discussing the eastern states that have shifted to regulated riparianism).

152 *See* GETCHES, *supra* note 145, at 48–49 (reviewing the case law that applies the reasonable use rule). As Professor Dellapenna notes, today "apart from a preference for domestic uses, the only real restriction is that a use is not lawfull [sic] if it 'unreasonably harms' another's riparian use." Dellapenna, *supra* note 134, at 422 (citation omitted). An early case which discussed "the

water rights is thus the "reasonableness" of the use, which is determined through a contextual, fact-specific analysis.[153] It is essentially a comparative analysis, comparing the fact pattern at

allocation of water in terms of . . . riparian rights" was *Merritt v. Parker*, which involved a dispute over competing uses between a watermill and a dam. *Id.* (citing 1 N.J.L. 526 (1795)). For similar early cases, see *id.* at 422 n.80 (citing Cooper v. Hall, 5 Ohio 320, 323 (1832); Parker v. Griswold, 17 Conn. 288, 296 (1845); Mason v. Hoyle, 14 A. 786, 788–89 (Conn. 1888); Heath v. Williams, 25 Me. 209 (Me. 1845); Pratt v. Lamson, 84 Mass. 275 (2 Allen) 275 (Mass. 1861); Hayes v. Waldron, 44 N.H. 580, 582 (N.H. 1863); Red River Roller Mills v. Wright, 30 Minn. 249,15 N.W. 167, 168 (Minn. 1883); Farrell v. Richards, 30 N.J. Eq. 511, 515 (N.J. Ch. 1879); Palmer v. Mulligan, 3 Cai. R.308 (N.Y. Sup. Ct. 1805); Howell v. McCoy, 3 Rawle 256, 269 (Pa. 1832); Richmond Mfg. Co. v. Atl. De Laine Co., 10 R.I. 106, 111 (R.I. 1871)).

153 The Second Restatement of Torts identifies several factors that should be considered in determining the reasonableness of the use. These include: the purpose of the use; the suitability of the use to the watercourse or the lake; economic value of the use; social value; the extent and amount of harm caused; practicability of avoiding harm; protection of existing values of water uses and investments; and the justice of requiring the use causing harm to bear the loss. RESTATEMENT (SECOND) OF TORTS §850 (AM. LAW INST. 1979).

Although some scholars have noted that while the Second Restatement allows for considering a wide range of factors, courts tend to give only minimal attention to non-economic questions such as the natural flow of the stream, social concerns, or notions of abstract justice. *See* Dellapenna, *supra* note 134, at 423 (noting that although such social concerns feature in the Restatement they are not dominant in the case law). Mostly, courts will rely on the economic value of the competing uses. Such was the case, for example, in *Harris*. 283 S.W.2d at 136.

In particular, the use of water for generating electricity is a well-recognized riparian use, which will generally be considered reasonable, depending on the storage and release methods, the stream size, the state of technology employed, and the uses of the stream by other riparian land-holders. Interestingly, although the riparian doctrine generally limits water use to the riparian land itself, electricity produced from hydroelectric dams are allowed to be transmitted and used by non-riparian users as well. *See* GETCHES, *supra* note 145, at 41–42. One limitation on the ability to harness the water for energy production is the prohibition on constructing dams on navigable water unless authorized by the Federal Government. *See id.* at 41–42 (referring to the Federal Power Act). However, a similar result seems to follow from the fact that navigable waters are generally owned by the states and not private riparian landowners. *See, e.g.*, Christine A. Klein, et al., NATURAL RESOURCE LAW: A PLACE-BASED BOOK OF PROBLEMS AND CASES 633 (2d ed. 2009) (explaining that "navigable" waters are generally held by states under the public trust doctrine); *see id.* at, 632–43. (discussing the scope of "navigability" in different contexts); Alexandra B. Klass, *The Public Trust Doctrine in the Shadow of State Environmental Rights Laws: A Case Study*, 45 ENVTL. L. 431, 432–33 (2015) ("The public trust doctrine . . . provides that states must hold certain natural resources, particularly submerged lands under tidal and navigable waters."); Alexandra B. Klass, *Modern Public Trust Principles: Recognizing Rights and Integrating Standards*, 82 NOTRE DAME L. REV. 699, 702–06 (2006) (discussing the origins of the public trust doctrine and its applicability to navigable waters).

hand with the uses of other riparian right holders.[154] This makes the analysis of "reasonableness" highly flexible, since it relies primarily on a comparative utility. Moreover, since courts are required to continuously re-evaluate the results in light of changing prices and realities, their assessment could also be subject to adjustments over time.[155]

2. *Applying the Traditional Riparian Regime to Wind Resources: Creating Riparian-Wind Rights*

Applying a riparian-like regime to wind resources might first entail establishing 'riparian-wind-lands.'[156] For example, landowners underlying a strong wind current would have a right to reasonably use energy within the wind stream howling over their land. Notably, under such a regime the use of wind would depend on land ownership. The reasonability of the use would also need to be determined: the extraction of energy would be weighed against other uses to determine the reasonability of the energy production.

Such a wind-riparian regime would be helpful in the sense that it is intuitive; it follows from the existing land patterns and is fairly easy to establish from an institutional perspective. Furthermore, a riparian-like regime exists de facto in some areas today, under which landowners feel free to utilize the wind howling over their lands. In Colorado, for example, a proposed bill suggested that the "ownership of the wind interest is originally vested in the several owners of the surface."[157] In other areas, the

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154 *See* GETCHES, *supra* note145, at 50–53; Dellapenna, *supra* note 134, at 423 (discussing the relative nature of the reasonableness analysis); *see, e.g.*, Hoover v. Crane, 106 N.W.2d 563 (1960).

155 *See* Dellapenna, *supra* note134, at 424–25 (noting that although courts may try to avoid this problem by selecting a pro-rata sharing mechanism to allocate the waters among the competing users, it still seems that when a significant change of circumstances occurs, re-evaluation would still be necessary). *See also* N. Gualala Water Co. v. State Water Res. Control Bd., 43 Cal. Rptr. 3d 821, 833 n.11 (Ct. App. 2006).

Although, at least in theory, once rights are assigned, parties can negotiate to readjust to changing costs and needs. Yet the option of bargaining is voluntary, and does not change the fact that rights can be re-challenged in courts, thus introducing further uncertainties for the parties involved and additional costs.

156 I use this phrase to draw on the term 'riparian lands' in the water context. *See* note 141 *supra* and accompanying text.

157 H.R. 10-1158, 67th Gen. Assemb., 2d Reg. Sess. (Colo. 2010). Although, as explained above, the legislation in Colorado also provides for a severable wind right, such that after the initial appropriation the wind rights can be

fact that landowners lease out the wind blowing over their land[158] also attests to a de facto riparian-like regime.

However, a riparian regime also suffers from substantial problems. While the flexibility of the riparian regime is advantageous because of its ability to adapt to multiple situations and account for a wide range of factors, it also creates great uncertainty for users. Since the use of the resource (whether water or wind) is subject to ex post judicial review, riparian users are faced with uncertainties regarding the scope of their rights. This uncertainty is often cited as a crucial problem of a riparian regime.[159] The vagueness of the comparative review and contextual nature of the "reasonableness" analysis further enhance the unpredictability of the system.[160] Such uncertainties could undermine the incentives for efficient investment in resources and development.

This could be true with regards to wind development where, despite a significant decrease in development prices, installing wind turbines still involves a significant upfront investment.[161] Therefore, given the costs of wind installations and the length of time needed to return the investment, a potential developer would need to estimate, inter alia, the risk of having her wind potential reduced due to interferences or competing users. Under a riparian system, for the reasons discussed above, a developer will face significant uncertainties as to the amount of wind available to her for energy production. These uncertainties would be even further complicated if all the landowners along the same wind current wished to erect wind turbines for energy production. In this situation, although the extraction of energy might be efficient, due to the uncertainties associated with a riparian regime, all the landowners would be discouraged from investing in turbines. This

separated from the underlying land and (presumably) traded. In that respect, the Colorado wind regime may be different from the riparian regime, under which water rights generally cannot be separated from land.

158 *See supra* Part II.A.

159 *See, e.g.*, Dellapenna, *supra* note 134, at 429 (discussing the effects of "the pervasive uncertainty that arises under traditional riparian rights").

160 As Professor Dellapenna notes, "the only firm rule under riparian rights is that any use on non-riparian land is per se unreasonable." Dellapenna, *supra* note 134, at 425.

161 *See, e.g.*, U.S. DEP'T OF ENERGY, 2014 WIND TECHNOLOGIES MARKET REPORT 47–50, 55–56 (2015) (discussing wind power costs trends and shifts in the price received for the sale of energy produced from wind).

could cause suboptimal utilization of the resource or lead to lost opportunity costs.

Another problem of the riparian system lies in its inherent inability to account for public interests.[162] This results from the nature of the adjudication of riparian rights and the fact that there is no mechanism for reviewing the rights of all users together. The adjudication of riparian rights, because they are administered through adversarial proceedings rather than legislative proceedings, typically involves only the parties to a particular dispute and will thus result in defining only the rights of those parties. Yet looking only at the parties to a specific dispute misses the full picture. Consider, for example, a dispute between a large industrial user and a single domestic user located downstream from the factory; the court will consider just the claims of these two particular users. In reality, there are often many more users along the same stream that are not considered simply because they are not formally parties to the dispute. Nor is the public, environmental interest in leaving enough of a flow for wild-life to flourish or for recreational activities represented in the dispute settlement process. Thus, due to the way in which the riparian rights are adjudicated, the analysis will generally neither address other users along the same stream, nor environmental or recreational concerns.[163] Moreover, even if all the users along the watercourse (or, in our case, the windcourse) could be joined in the same action, the public interest will still be typically under-represented.[164] Furthermore, once the rights have been adjudicated there is little room for new public necessities or values to be taken into account.

For the same reason, the riparian system suffers from a

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162 This is due to courts' difficulties in accounting for the public interest within litigation. *See* Dellapenna, *supra* note 134, at 425–26.

163 Similarly, Carol Rose pointed out that the riparian water rights analysis tends to prefer hydropower and industrial uses over other competing uses. Carol Rose, *Energy and Efficiency in the Realignment of Common-Law Water Rights*, 19 J. LEGAL STUD. 261, 278–85, 294–96 (1990).

164 *See* Dellapenna, *supra* note 134, at 425–26 (discussing the "systematic bias in favor of large users"); *See generally* Lynda L. Butler, *Allocating Consumptive Water Rights in a Riparian Jurisdiction: Defining the Relationship between Public and Private Interests*, 47 U. PITT. L. REV. 95 (1985–1986) (suggesting how courts may better account for the public interest); Peter N. Davis, *The Riparian Right of Streamflow Protection in the Eastern States*, 36 ARK. L. REV. 47, (1982–1983) (on public rights to flow levels).

systematic bias towards large users. Consider again the dispute between a large industrial user and a single domestic user located downstream from the factory. In settling the dispute, the court will look at the relative utility of each party and determine their rights accordingly. Since the factory is likely to have greater utility than a single household, it will typically be favored.[165] That analysis may not always hold true if we consider the accumulated utility of all the households along the wind-current. Because disputes are adjudicated only between parties to a specific dispute, such aggregated considerations are not taken into account, and the result inefficiently favors large users. When applied to wind, this could mean disfavoring distributed generation over other competing large-scale production sites.

The problems associated with the riparian system essentially derive from the nature of the regime as a common property regime, under which all members of the community are entitled to use the resource. In other words, the riparian regime does not necessarily avoid the difficulties of the tragedy of the commons.[166] Thus, riparian wind rights might be relevant mostly for areas where there is less competition for the resources—analogous to the relative abundance of the water in riparian states—and where the problem of the tragic commons is less likely to arise.

In sum, the traditional riparian regime is the current de facto situation in some areas where landowners utilize the wind blowing over their lands, and this solution may be appropriate for areas with abundant wind resources. However, it is doubtful that this is a desirable solution for areas where the wind consumption is more competitive, or where the use of wind resources is expected to be more extensive.

B. *Prior Appropriation*

1. *Prior Appropriation Water Regime*

In the western states, water was treated as a scarce resource, and, consequently, the right to use water was treated like private

165 *See* Dellapenna, *supra* note 134, at 425 (citing Wallace v. City of Winfield, 149 P. 693, 695 (Kan. 1915); Fagen v. Mayor of Wharton, 113 A. 920, 920 (N.J. 1920); Smith v. City of Brooklyn, 54 N.E. 787, 788 (N.Y. 1899); Pernell v. City of Henderson, 16 S.E.2d 449, 451 (N.C. 1941); Town of Purcellville v. Potts, 19 S.E.2d 700, 702–03 (Va. 1942)).

166 *See* Dellapenna, *supra* note 134, at 426–27 (discussing water).

property[167] under a system known as "prior appropriation."[168] At the heart of the prior appropriation regime, as the name suggests, is the rule of first-in-time-first-in-right, such that senior users are given preference over junior ones. Appropriative rights are defined with regards to the place, quantity, and manner of the use, but—notably—based on their priority in time.[169] Unlike riparianism, prior appropriation does not require ownership of land.

To establish an appropriative right, a user must have made beneficial use of the water.[170] A "beneficial" use is determined by the quantity of water that can be put to valuable, constructive use,[171] and measured by the quantity that can reasonably be put to such a beneficial use.[172] However, the seniority rule still governs the allocation, such that the senior user would be favored even if a

167 *See* GETCHES, *supra* note 145 at 85–88 (discussing in detail the features of appropriative rights as property). Getches explains that, while the water itself typically will belong to the state, appropriative right holders are assigned title to the use of a particular amount of water once it is appropriated. Also note that prior appropriation water rights "cannot be taken from an appropriator by the state or federal government without just compensation." *Id.* at 87. *See, e.g.*, Dep't of Ecology v. Grimes, 852 P.2d 1044, 1054–55 (Wash. 1993) ("A vested [prior appropriation] water right is a type of private property that is subject to the Fifth Amendment prohibition on takings without just compensation"). However, appellant in that case did not succeed in asserting takings claims. *Id.*

168 The doctrine of prior appropriation was first adopted to accommodate mining needs in the American West and is generally believed to be consistent with the miners' pre-existing behaviors. GETCHES, *supra* note 145 at 81–82; *see, e.g.*, Irwin v. Phillips, 5 Cal. 140, 148 (1855) (holding that a miner who had diverted water from a stream to use in his off-site mining operations had superior rights to a later miner who was seeking to use the water on riparian lands). *But cf.* David B. Schorr, *Appropriation as Agrarianism: Distributive Justice in the Creation of Property Rights*, 32 ECOLOGY L.Q. 3 (2005) (analyzing the origins of the prior appropriation doctrine and challenging the traditional view of prior appropriation as driven solely by economic growth and mining needs).

169 GETCHES, *supra* note 145 at 6; Dellapenna, *supra* note 134, at 432–34.

170 GETCHES, *supra* note 145 at 77.

171 *Id.* at 78. Such "beneficial" uses are, for instance, domestic, municipal, agricultural and industrial uses. *Id.* at 103–05.

172 *Id.* at 79 (arguing that the reasonableness requirement should, in theory, prevent wasteful practices since using more water than is reasonably necessary should not be considered reasonable and therefore should not be considered a beneficial use for the purpose of establishing an appropriative right); *see, e.g.*, Dep't of Ecology v. Grimes, 852 P.2d 1044, 1049 (Wash. 1993) (discussing how "beneficial use" is determined noting that "[t]o determine the amount of water necessary for a beneficial use, courts have developed the principle of 'reasonable use,'" which includes an analysis of the uses to which the water is put, *id.* at 1050, and consideration of waste, *id.* at 1051).

junior user claims a more beneficial use.[173]

Users seeking to establish appropriative rights also need to adhere to the 'use-it-or-lose-it' rule. If the use is discontinued at some point, the user may lose her right.[174] Historically, creating an appropriative right also typically involved a diversion requirement—a right was established only when the water was diverted away from its natural course or location.[175] Thus, an appropriative system favors extractive uses (such as irrigation), while non-consumptive and in-stream uses (such as environmental or recreational concerns) were not facilitated. Today, however, the diversion requirement is seen as more flexible, and a tangible "physical diversion from the stream" is often no longer required.[176] In-stream uses are, thus, recognized today in some states, mostly by granting in-stream rights to a state agency.[177]

Lastly, it should be noted that water rights under the prior appropriation regime can be traded as private property rights. However the trade of such rights is subject to the "no-injury rule," such that the transfer cannot injure a more junior, recognized user, thus forcing the parties to account for the externalities of the transaction.[178]

2. *Applying the Prior Appropriation Regime to Wind Resources*

Applying the prior appropriation regime to wind would entail a 'first-in-time-rule,' such that senior wind users will be superior in rights to junior ones. Assuming the production of energy would be found beneficial, if a wind-turbine farm was constructed early

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173 GETCHES, *supra* note 145 at 77–79.

174 *Id.* at 79.

175 *Id.* at 77, 97–103. Methods of diversion include dams, canals, reservoirs, pipes and pumps. *Id.* at 98.

176 *Id.* at 101; Getches also explains that historically the diversion requirement served as a signal to other users that the water has been "claimed," although, given that most western states use some form of permitting system to govern the prior appropriation system today, the diversion requirement has become less significant. *Id.* at 97.

177 *Id.* at 102. These states include: Alaska, California, Colorado, Hawaii, Idaho, Kansas, Montana, Nebraska, Oklahoma, Oregon, Utah, Washington and Wyoming. In-stream appropriations are typically allocated only to a state agency. *Id.*

178 Getches explains that courts have found that when a senior right-holder wishes to change the place of extraction, purpose or time of use, she is obligated to ensure a junior right-holder the same conditions that existed at the time the junior right was established. *Id.* at 109.

on, junior users in both the upwind and downwind directions might not be able to construct wind turbines of their own. The new upwind user would not be allowed to subtract from the wind available to the senior right-holder, and the downwind user would be in the wake of the senior right-holder's wind farm.

A prior appropriation regime, as explained above, is akin to a private property regime. The advantage of individual property rights is that they provide incentives for investment in the resources.[179] Appropriative rights are also advantageous as compared to traditional riparianism with regards to the predictability that the first-in-time rule provides (at least insofar as seniority in time is a clearer criterion than a "reasonableness" analysis).[180] The increased certainty a senior user has as to her rights may foster investment in the resource. In the case of wind, the increased certainty could induce investment in wind energy development, accelerating the rate of wind energy growth, at least in the short term.[181]

However, establishing a first-in-time right might often be a complicated task, which requires extensive historical evidence.[182]

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179 *See, e.g.*, Gary D. Libecap, *Open-Access Losses and Delay in the Assignment of Property Rights*, 50 ARIZ. L. REV. 379, 381 (2008); BARRY C. FIELD, NATURAL RESOURCES ECONOMICS: AN INTRODUCTION 110–14 (2d ed. 2008). *See generally* Bruce Yandle & Andrew P. Morriss, *The Technologies of Property Rights: Choice Among Alternative Solutions to Tragedies of the Commons*, 28 ECOLOGY L.Q. 123 (2001) (analyzing the ways in which property rights address the "tragedy of the commons," including the incentives provided by a system of property rights).

180 On the uncertainties associated with a 'reasonableness' analysis under a riparian system, *see* Dellapenna, *supra* note 134, at 425, 429.

181 As mentioned, the uncertainties currently associated with the state of wind rights could deter investment, inter alia, due to the risk of costly litigation. *See supra* note 78 and accompanying text; *see also* Rule, *supra* note 42, at 210 (discussing specifically the uncertainties due to potential profit loss through lawsuits). Accordingly, alleviating some of the uncertainties might serve to foster investment.

182 Despite the judicial and administrative efforts, in some watercourses the earliest (and thus the most valuable) rights have not yet be quantified. Abandoned or forfeited rights can also cause confusion and gaps in the records. *See* Dellapenna, *supra* note 134, at 432–34 (citing the following cases that recognize prescriptive rights: Gibbons v. Globe Dev., Nev., Inc., 553 P.2d 1198 (Ariz. 1976); Sears v. Berryman, 623 P.2d 455 (Idaho 1981); as well as cases and statutes refusing to recognize prescriptive rights: Alaska Stat. § 46.15.040(a) (2008); Idaho Code Ann. § 42-607 (2003); Kan. Stat. Ann. § 82a-705 (1997); Nev. Rev. Stat. § 533.060(5) (2007); Utah Code Ann. § 73-3-1 (1989); People v. Shirokow, 605 P.2d 859 (Cal. 1980)).

Thus, the realms of the rights under prior appropriation might not be as certain as they seem. Moreover, the central problem of the prior appropriation regime is that a rule-of-capture actually encourages suboptimal and premature exploitation of the resource. In an appropriative world, each user is encouraged to use as much of the resource as they possibly can, before it is necessary and regardless of whether it will ever be necessary at all.[183] Since every user seeks to maximize her future gains, she has an incentive to use the resource prematurely, or in ways that might be wasteful and inefficient.[184] For example, a farmer might be induced to plant crops that require heavy irrigation (rather than less wasteful crops) only to maintain her future water rights.

Even if all appropriators only divert as much of the resource as they actually need, the rule of capture still violates the basic economic principle of marginal productivity.[185] When there is not enough of the resource to meet everyone's needs, the most junior user will have to forego all of her rights before any of the senior users will lose their rights.[186] This result will occur regardless of the efficiency of the competing uses.[187] In other words, the junior user may be more efficient—for example, it may have installed more efficient turbines or may be located at a more cost-effective site—yet the senior user will still 'win.' Thus, absent an efficient

183 Dellapenna, *supra* note 134, at432–34; *see generally* John D. Leshy, *The Prior Appropriation Doctrine of Water Law in the West: An Emperor with Few Clothes*, 29 J. WEST 5 (1990); Janet C. Neuman, *Beneficial Use, Waste, and Forfeiture: The Inefficient Search for Efficiency in Western Water Use*, 28 ENVTL. L. 919 (1998).

184 *See generally* Leshy, *supra* note183; Neuman, *supra* note 183. A rule of first in time has been criticized as leading to premature consumption, or wasteful uses, where the resource could have otherwise been used more productively. *See, e.g.*, David D. Haddock, *First Possession Versus Optimal Timing; Limiting the Dissipation of Economic Value*, 64 Wash. U. L. Q. 775, 777 (1986) ("[A]warding entitlements by first possession leads to . . . premature expenditures . . . [since] the anticipation of capturing property of future value induces abandonment of alternative pursuits of positive current productivity."); Dean Lueck, *The Rule of First Possession and the Design of the Law*, 38 J. L. & Econ. 393, 394 (1995) ("[C]ritics have recognized correctly that first possession has the potential to dissipate wealth—either from a wasteful race to claim an asset or as a rule of capture that leads to overexploitation.").

185 Dellapenna, *supra* note 134, at 434; *see generally* Herbert Hovenkamp, *Marginal Utility and the Coase Theorem*, 75 CORNELL L. REV. 783 (1990).

186 GETCHES, *supra* note 145 at 78.

187 *See* Dellapenna, *supra* note 134, at 434 (referring to "one of the most extreme examples of this," State *ex rel.* Cary v. Cochran, 292 N.W. 239 (Neb. 1940)).

trading system (as will be discussed further below), the resource is not directed to the next unit of marginal productivity. Furthermore, senior users are not encouraged to pool the risk with more junior ones, because they will always have enough of the resource to secure their needs, regardless of the changing conditions.[188]

In the case of wind, a rule-of-capture would encourage—for example—the construction of large wind farms in certain locations for the purpose of establishing appropriative wind rights, even if a more efficient location may exist. A rule of capture would thus yield an inefficient result when the location to be developed first has lower energy potential than a competing neighboring location.[189] The downwind location might be more suitable for wind energy production, yet it may never be developed because it will be subject to the senior wind rights. A similar analogy follows if the more efficient location was actually upwind from the first-in-time installation, since the senior user would still be entitled to the same amount of wind she initially captured. This means that the more efficient upwind location will not be able to extract wind for energy production, because it will not be allowed to subtract from the wind available to the senior downwind right-holder. Siting of wind installations under a prior appropriation regime will therefore not reflect the relative efficiency of wind energy capacity in each locality, but rather will be driven by the need to establish senior wind rights.

In addition, a seniority-based regime also entrenches existing uses and allows for very little adjustment to be made once initial rights are established.[190] Therefore, once an inefficient siting has taken place, it is hard to shift the resource allocation; thus, the inefficient situation is "locked in."[191] New users may be more productive and efficient than old ones, especially with rapidly changing technologies and increased understanding of wind behavior and energy capacity as time goes by. Yet the junior user will be blocked from materializing her efficient use, denying her—

188 *See* Dellapenna, *supra* note 134, at 434.

189 *See* Rule, *supra* note 42, at 228.

190 *See* Thomas J. Graff & David Yardas, *Reforming Western Water Policy: Markets and Regulation*, 12 NAT. RESOURCES & ENV'T. 165, 165 (1998).

191 However, recent case law suggests that the customary amounts do not necessarily determine the reasonable amount for the purpose of appropriative rights, and thus might allow room for reallocating resources more efficiently. *See, e.g.*, Dep't of Ecology v. Grimes, 852 P.2d 1044 (Wash. 1993).

and society at large—the benefits of the most efficient use of the wind. In addition, since appropriative rights are akin to private property, they are also subject to hold-out problems.[192] Senior right-holders may therefore strategically use their power to prevent the efficient development of wind energy production in the area.[193]

Appropriative rights also tend to favor large users. As mentioned above, to establish rights under the appropriation system, the resource must be used beneficially.[194] The ability, however, to make beneficial use is often a function of the size of land or the installation one owns. Appropriative rights, therefore, tend to favor large users with more resources, who can take advantage of economies of scale to make more beneficial uses.[195] Here again, the aggregated utility of many small users may be inefficiently lost in the process.

Lastly, the traditional appropriative system did not afford much protection to the public interest, since it primarily followed the first-in-time rule.[196] Today however, many prior appropriation states do facilitate some consideration of the public interest, within the review of new appropriations.[197] This has, to some extent,

192 *See generally* Richard A. Epstein, *A Clean View of the Cathedral: The Dominance of Property Rules*, 106 YALE L.J. 2091 (1997); Richard A. Epstein, *Holdouts, Externalities, and the Single Owner: One More Salute to Ronald Coase*, 36 J. L. & ECON. 553 (1993).

193 Since senior right-holders have priority and can prevent or limit junior right-holders' use of the resource, there is a concern that they might strategically misuse their priority in order to gain an unwarranted advantage. *See generally* Richard A. Epstein, *Holdouts, Externalities, and the Single Owner: One More Salute to Ronald Coase*, 36 J. L. & ECON. 553 (1993) (discussing the holdout problem).

194 *See* GETCHES, *supra* note 145, at 77–79, 103–05; *see also supra* text accompanying notes 171–173.

195 Dellapenna, *supra* note 134, at 435.

196 A. Dan Tarlock, *The Future of Prior Appropriation in the New West*, 41 NAT. RESOURCES J. 769, 772 (2001) (noting problems with prior appropriation doctrine including that the "perpetual 'use it or lose it rights' lock too much water into marginal agriculture and generally inefficient off-stream consumptive uses to the detriment of aquatic ecosystem values and the needs of growing urban areas").

197 GETCHES, *supra* note 145 at 80; Dellapenna, *supra* note 134, at 435–36 (citing Neb. Const. art. XV, § 6; Hardy v. Higginson, 849 P.2d 946, 949 (Idaho 1993); Pyramid Lake Paiute Tribe v. Washoe County, 918 P.2d 697, 698 n.3 (Nev. 1996); Consuelo Bokum, *Implementing the Public Welfare Requirement in New Mexico's Water Code*, 36 NAT. RESOURCES J. 681 (1996); Douglas L. Grant, *Instream Flow Protection and Public Interest Review of Appropriations*, 5 RIVERS 294 (1995)).

mitigated concerns about unprotected public interests under the appropriative system. Yet this willingness to accommodate some of the public concerns does not seem to outweigh the complexities discussed above, especially since a consideration of the public interest is also available under the regulated riparianism regime, as will be discussed below. For all these reasons, it seems that the prior appropriation system is less suitable for coping with the complexities associated with wind resource allocation.

C. *Regulated Riparianism*

1. *Regulated Riparianism Water Regime*

Changing water needs in the twentieth century led about half of the eastern states to adopt a modified permitting system, often known as "regulated riparianism."[198] This model is based on the

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However, importantly, since the consideration of the public interest is only called for within the review of *new* appropriations, in practice, it may have only a minor effect, especially in basins where the majority of the water was previously appropriated. *Id.* at 429 (citing Norman K. Johnson & Charles T. DuMars, *A Survey of the Evolution of Western Water Law in Response to Changing Economic and Public Interest Demands*, 29 NAT. RESOURCES J. 347 (1989)).

198 *See* Dellapenna, *supra* note 134, at 414 (discussing the changing water needs in the 20th century), and at 439–40, nn. 184–201 (listing the states which he believes have adopted regulated riparian systems (including the relevant legislation): (1) Alabama (ALA. CODE §§ 9-10B-1 to 9-10B-30 (2001)); (2) Arkansas (ARK. CODE ANN. §§ 15-22-201 to15-22-622 (2003)); (3) Connecticut (CONN. GEN. STAT. §§ 22a-365-22a-380 (West 2006)); (4) Delaware (DEL. CODE ANN. tit. 7, §§ 6001-6031 (2001)); (5) Florida (FLA. STAT. §§ 373.012-.619 (2006)); (6) Georgia (GA. CODE ANN. §§ 12-5-20 to 12-5-31, 12-5-43 to 12-5-53 (2006)); (7) Hawaii (HAW. REV. STAT. ANN. § 174C (2008)); (8) Iowa (IOWA CODE ANN. §§ 455B.261–455B.281 (2004)); (9) Kentucky (KY. REV. STAT. ANN. §§ 151.010–151.600, 151.990 (2006)); (10) Maryland (MD. CODE ANN., ENVIRONMENT §§ 5-501 to 5-514 (2007)); (11) Massachusetts (MASS. GEN. LAWS ANN. ch. 21G, §§ 1-19 (2002)); (12) Minnesota (MINN. STAT. ANN. §§ 103G.001-103G.315 (1997)); (13) Mississippi (MISS. CODE ANN. §§ 51-3-1 to 51-3-55 (1999)); (14) New Jersey (N.J. STAT. ANN. §§ 58:1A-1 to 58:1A-17 (2006)); (15) North Carolina (N.C. GEN. STAT. §§ 143-215.11 to 143-215.22K (2007)); (16) New York (N.Y. ENVTL. CONSERV. LAW §§ 15-1501 to 15-1529 (2006)); (17) Virginia (VA. CODE ANN. §§ 62.1-242 to -253 (2006)); and (18) Wisconsin (WIS. STAT. ANN. §§ 30.18, 30.28, 30.292-30.298, 281.35 (2006))). *See also* D.S. Pensley, *The Legalities of Stream Interventions: Accretive Changes to New York State's Riparian Doctrine Ahead?*, 25 PACE ENVTL. L. REV. 105, 120–23 (2008) (discussing the shift toward regulated riparianism); Scott S. Slater, *State Water Resource Administration in the Free Trade Agreement Era: As Strong as Ever*, 53 WAYNE L. REV. 649, 671 (2007) ("It is noteworthy that common law riparianism is rapidly giving way to regulated riparianism.").

traditional riparian concept of "reasonable use," but is governed by an administrative system.[199] Put differently, it is an administrative permit system that allocates water rights based on the reasonableness of all users. Under a regulated riparianism system, use rights are determined ex ante by an administrative state agency as opposed to ex post by the judiciary.[200] Water withdrawal cannot take place without obtaining "a time-limited permit from the state within which the withdrawal occurs."[201]

The riparian tradition is continued in the sense that permits are still granted based on the reasonable use rule.[202] Notably, the administrative system looks not only at the individual permit holder, but also at other public interests.[203] The riparian statutes often provide for specific types of uses[204] and for the explicit protection of the public interest.[205] Under most regulated riparian systems, permits are granted for set time periods (between three and twenty years)[206] and are typically renewable, subject to re-

199 *See* Joseph W. Dellapenna, *The Importance of Getting Names Right: The Myth of Markets for Water*, 25 WM. & MARY ENVTL. L. &POL'Y REV. 317, 366–67 (2000) [hereinafter Dellapenna, *Markets for Water*] ("The most fundamental departure from common law riparian rights in regulated riparian statutes is the requirement that, with few exceptions, water cannot legally be withdrawn from a water source except pursuant to a permit issued by the state in which the withdrawal occurs. . . . The 'riparian' element comes from the criterion by which permit applications are judged, namely whether the proposed use is 'reasonable'"); Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 454 (2008) ("[W]ater law in the East is moving toward a regulated riparianism under which the basic riparian system is overlaid with regulation and official permits.").

200 *See* Pensley, *supra* note 198, at 121.

201 *See* Dellapenna, *supra* note 134, at 440–41, also referring to Am. Soc'y of Civil Eng'rs, THE REGULATED RIPARIAN MODEL WATER CODE: FINAL REPORT OF THE WATER LAWS COMMITTEE § 6R-1-01 (Joseph W. Dellapenna ed., 1997) [hereinafter MODEL CODE]; GETCHES, *supra* note 146, at 58–59.

202 *See* GETCHES, *supra* note 145, at 60–61; Dellapenna, *supra* note 134, at 441 (noting that some jurisdictions may supplement the terms "beneficial," "reasonable-beneficial," or "equitable" for "reasonable"). Another way in which regulated riparianism departs from the traditional system is that uses on non-riparian land are not unreasonable per-se. *Id.*at 441.

203 *See* Dellapenna, *supra* note 134, at 441; *see also* MODEL CODE, *supra* note 201, at § 7R-1-01(l).

204 One example of this could perhaps be the right of way permits established by the BLM for the use of wind blowing over federal lands (*see infra* Part II), although the discussion here is not limited to the BLM permits.

205 *See* Dellapenna, *supra* note 134, at 441; GETCHES, *supra* note 145, at 60; *see also* MODEL CODE, *supra* note 201, at §§ 4R-2-01 to -04.

206 *See* Dellapenna, *supra* note 135, at 441.With some exceptions for certain

evaluating reasonableness in light of any new developments.[207] Permits may also be revisited in times of severe scarcity or emergency needs.[208] Regulated riparianism can be understood as analogous to a public ownership model,[209] in the sense that the water belongs collectively to all members of the state, and individual use is permitted only subject to explicit permission.

2. *Applying Regulated Riparianism to Wind Resources: Creating Wind-Use Permits*

Applying a regulated riparianism regime to wind resources entails establishing a system for allocating wind use permits, limited to a certain time period and subject to certain conditions set out by the administrative agency.[210]

A regulated riparianism regime for wind may be complicated and expensive to establish, as there are substantial costs involved in imposing an elaborate administrative system.[211] In addition, since regulated riparianism relies essentially on the reasonable use rule, some of the problems associated with the application of a reasonableness analysis could apply as well.

Furthermore, it is not always clear that the administrative system is sufficiently informed to handle such complex resource allocation. Determining how much wind can be extracted is a particularly challenging task. For instance, deciding at what point the benefit of energy production outweighs the costs of leaving the homes in the downwind direction without a breeze is a complex analysis. Deciding how much wind needs to be left for environmental and recreational purposes further complicates the analysis.[212] Taken together, this becomes a challenging

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public-related projects, the Regulated Riparian Model Water Code sets twenty years as the duration of the permits. *See* MODEL CODE, *supra* note 201, at § 7R-1-02.

207 *See* Dellapenna, *supra* note 134, at 441; GETCHES, *supra* note 145, at 61.

208 However, it is not clear how often review powers are in fact used. Regulated riparian regimes typically provide for a hearing process within the agency and for judicial review of agency decisions, although courts mostly tend to defer to the agency's review on this matter. *See* Dellapenna, *supra* note 134, at 442.

209 *See* Dellapenna, *supra* note 134, at 414–15.

210 The permits issued by the BLM for the extraction of wind from BLM-managed lands (*see infra* Part II) could serve as an illustrative example, although the analysis here is not limited to such permits. .

211 *See* Dellapenna, *Markets for Water*, *supra* note 199, at 373–75.

212 *See* Carol M. Rose, *Expanding the Choices for the Global Commons:*

examination requiring significant knowledge and expertise.

Managing wind currents requires obtaining and studying large amounts of information in various fields, such as meteorological conditions, geographical features of the region, and production and technology costs. The agency may be in a better position to obtain the necessary information with regards to some of these fields. For instance, the agency may be able to invest more in research pertaining to the meteorological conditions of the entire district or study the cumulative environmental effects of constructing huge wind farms throughout the region. Yet with regards to other types of information, such as production costs and methods, the industry is more likely better positioned to obtain the necessary data. Industry has access to information in this respect that may be impossible or prohibitively costly for the administrative agency to obtain.[213]

The administrative system may also be subject to increased political pressures compared with the judicial system, which is typically thought to be more immune from such strains. There might be concerns over captured interests that negatively influence the decision-making process within the agency.[214] For instance, various interest groups, such as producers of wind turbines or large scale wind farm developers, which stand to benefit considerably from the expansion of wind development, might be inclined to weigh in on agency decision making in various ways.

Despite these difficulties, regulated riparianism has some significant advantages. First, the determination of ex ante rights by the administrative system provides for increased certainty, as

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Comparing Newfangled Tradable Allowance Schemes to Old-fashioned Common Property Regimes, 10 DUKE ENVTL. L. & POL'Y F. 45, 53–58 (1999) (discussing the complexities involved in setting the contours of the permits, and specifically in defining the "total allowable resource use," albeit in a different context than water permits).

213 Consider, for instance, the information relating to costs of siting, turbine installation and ongoing maintenance, employee training for wind-related installations, and more.

214 Agency capture theory suggests that special interests wield undue influence over an agency because of the regulated industries' increased motivations and abilities to lobby, as compared to the unorganized general public. *See, e.g.*, Bradford C. Mank, *Superfund Contractors and Agency Capture*, 2 N.Y.U. ENVTL. L.J. 34, 49–54 (1993) (discussing specifically the application of agency capture theory to the EPA); *see* Reid Mullen, *Statutory Complexity Disguises Agency Capture in Citizens Coal Council v. EPA*, 34 ECOLOGY L.Q. 927, 931 (2007).

compared to the traditional riparian regime. A permit holder knows in advance exactly how much of the resource she can use and for how long.[215] Investors would therefore be able to rely on the amount of resources available to them and the expected return period on their investment. Increased certainty ex ante would foster efficient investment in resource development, furthering the utilization of wind energy for the benefit of local residents, as well as green-house gas reductions. At the same time, because regulated riparianism is not subject to a rule-of-capture (unlike the prior appropriation regime), it is not expected to push for premature and extraneous development.[216] In short, a wind rights permitting system will avoid both the problem of uncertain conditions that hinder development associated with traditional riparianism, and the difficulties of a rule of capture and hasty development associated with prior appropriation. It could potentially allow for optimal investment in wind energy development.

A permitting system may be especially advantageous in areas where the competition over wind use is great or rapidly increasing. As mentioned, higher proximity of users is likely to increase the conflicts over energy extraction; although wind is renewable, it may be slowed down in the short term, and, depending on the ground conditions,[217] it may never regain its prior speeds. In other words, the recovery of wind requires time and distance, so the closer users are to each other, the less likely that recovery will take place. Accordingly, in denser user areas, landowners are more likely to come into conflict over wind use. In such a situation, the problems of premature capture or the fear of interference that might hinder investment become all the more pressing. Therefore, particularly where the proximity of the users is increased and the competition over the existing wind resources is high, an administrative permit system is all the more necessary. Urban areas might become an interesting example of such a competitive environment, due to the recent expansion of distributed generation and small wind installations.[218]

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215 *See* Dellapenna, *supra* note 134, at 440–41.

216 *Id.* at 433.

217 The frictional drag of trees, rocks, valleys or even buildings can slow the wind down. *See* AHRENS, *supra* note 6, at 215. For a more detailed description of the physical forces that influence the wind, see *id.*at 205–09.

218 *See supra* notes 53–55 (discussing distributed generation and small wind growth).

The efficient development under such a permitting system will depend on the manner in which the permits are crafted. If the duration of the permit is too short, there may not be enough time to recover the costs of the investment, and developers would likely avoid the investment altogether.[219] This may be particularly true with regards to wind, because, although the cost of wind producing technology has significantly dropped in recent years, there are still substantial initial investments and long return periods.[220] Although, this problem may be mitigated by extending the duration of the permits to allow for investment to take place. Additional uncertainty could result, again like in the case of water,[221] from the agency's power to revisit and modify permits in times of emergencies. However, this does not seem to be a substantial problem with water permits, as it appears that "agencies seldom . . . refuse to renew a permit."[222] Similar agency behavior could possibly be expected with regards to wind permits.

Second, regulated riparianism is also favorable in its ability to account for the interests of all the affected users along the wind-stream. As opposed to both traditional riparianism and prior appropriation, reviewing the allocation of permits ex ante by the agency allows taking into consideration all interests involved at the time.[223] For instance, the agency is likely to be in a better position to assess the aggregated effects of small wind producers. These cumulative impacts may be extremely beneficial in terms of greenhouse gas reductions, yet there could also be problems that

219 *See* George A. Gould, *A Westerner Looks at Eastern Water Law: Reconsideration of Prior Appropriation in the East*, 25 U. ARK. LITTLE ROCK L. REV. 89, 109–10 (2002).

220 *See supra* Part IV.A.ii.

221 *See* Joseph W. Dellapenna, *Adapting Riparian Rights to the Twenty-First Century*, 106 W. VA. L. REV. 539, 591–92 (2004); Dellapenna, *supra* note 134, at 445.

222 *See* Dellapenna, *supra* note 134, at 445 (also noting that evidence suggests that the problem is actually the opposite one: that agencies often insufficiently use their powers rather than use them too aggressively); Dellapenna, *Adapting Riparian Rights to the Twenty-First Century*, *supra* note 221, at 591–92.

223 This is definitely true for the initial round of permit allocations, before any rights have been allocated (and assuming no right holders are grandfathered in). For the subsequent rounds of allocations or reviews of permit renewals, it is not clear that the permits would expire at the same time. As a result, they might not in fact be evaluated together. In any case, the agency might still be in a better position to evaluate the renewal of permits, given that it has the relevant information about the permits it has issued at any given time, regardless of when they expire.

are similar to those that occur with the construction of too many dams on a river. Either way, the agency would have the broader outlook necessary to address these cumulative impacts. Yet, if the allocation of wind rights were to depend on a rule of capture (as with prior appropriation) or a singular comparative utility analysis (as with traditional riparianism), these cumulative impacts will likely be overlooked. Whereas the agency examining the entire wind basin will be in a better position to assess the aggregated impacts of wind energy production in the region or neighborhood, both in terms of its ability to have a broader outlook and its capability to re-arrange permits if necessary according to the cumulative impacts of wind-production.

Furthermore, an administrative permitting system may also be better positioned to protect the public interest, including the ecosystem uses of the wind. As mentioned, wind has an important role in our natural environment, from the creation of weather conditions to the pollination of seeds. Here again, it seems that an ex ante permit allocation system is best suited to account for such needs. Neither the prior appropriation nor the traditional riparian regime can sufficiently account for the ecosystem values of the wind. Whereas regulated riparian systems often address such concerns through the mandated considerations of the public interest, such as, for example, a requirement to "protect some minimum flow" for wildlife preservation or for human well-being.[224] The Regulated Riparian Model Water Code, for example, "requires protection of the biological, chemical, and physical integrity of the water source, defined in terms of federal, state, and other relevant legal standards."[225] Similar mandates could possibly be enacted with regards to wind permit allocation, requiring the agency to consider preserving some minimum wind current for wildlife preservation or human welfare.

In addition, depending on the level of government charged with allocating the wind rights and the state involved, allocating

224 Dellapenna, *supra* note 134, at 443–44. *See, e.g.*, Lee P. Breckenridge, *Maintaining Instream Flow and Protecting Aquatic Habitat: Promise and Perils on the Path to Regulated Riparianism*, 106 W. VA. L. REV. 595, 612–20 (2004) (discussing the regulatory challenges of achieving instream flow and protecting aquatic ecosystems); Christine A. Klein, *On Integrity: Some Considerations for Water Law*, 56 ALA. L. REV. 1009, 1047 n.281 (2005) (noting which riparian states have incorporated stream flow protections into their regulations).

225 *See* Dellapenna, *supra* note 134, at 443–44.

administrative permits might also be subject to the National Environmental Policy Act (NEPA)[226] or an equivalent state legislation. The agency would thus be required to perform an environmental review,[227] which may include the ecosystem impact of extracting large amounts of energy from the wind in a particular location. While the mandate of NEPA-like regimes in states is sometimes limited to merely conducting an environmental study and may not amount to a concrete obligation to protect the ecosystem,[228] reviewing the environmental impacts of wind energy production may nevertheless be beneficial. At the very least it could highlight the impacts of energy extraction that are often not accounted for due to problems of collective action and externalities discussed above.

In sum, although regulated riparianism is not a perfect system and it no doubt has some difficulties, it is the regime best-suited to address the challenges of wind right allocation and the challenges of future energy production. An administrative permitting system allows users sufficient certainty to ensure investment, yet at the same time takes the public interest into account when necessary. This is especially true in regions where competition over the use of wind resources is higher, such as in urban areas.

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226 42 U.S.C. §§ 4321–4370h (2012).

227 This environmental review could be an Environmental Assessment or could amount to a full Environmental Impact Statement, provided that the proposed "major federal action" is "significantly affecting the quality of the human environment." 42 U.S.C. § 4332 (2012);*see also* CHRISTINE A. KLEIN, FEDERICO CHEEVER & BRET C. BIRDSONG, NATURAL RESOURCES LAW: A PLACE-BASED BOOK OF PROBLEMS AND CASES 133–45 (2d ed. 2009); Mary K. Fitzgerald, Comment, *Small-Handles, Big Impacts: When Should the National Environmental Policy Act Require an Environmental Impact Statement?*, 23 B.C. ENVTL. AFF. L. REV. 437, 437–44 (1996); George J. Skelly, Note, *Psychological Effects at NEPA's Threshold*, 83 COLUM. L. REV. 336, 336–39 (1983).

228 *See, e.g.*, RICHARD L. REVESZ, ENVIRONMENTAL LAW AND POLICY 808, 816 (2008) (discussing the nature of the obligations under NEPA, and noting specifically that states' "NEPA-like programs . . . all adopt the basic imprint of the federal scheme"). However, some of the "little NEPAs" do contain substantial obligations, which might suggest that state agencies would be required to consider the environmental impact of a proposed permitting action. *See id.* at 808, 816 ("[S]ome state NEPAs create substantive obligations on the part of state agencies to consider the environmental impacts of a proposed action.").

D. *Markets*

1. *Water Markets*

In addition to the three water regimes mentioned, in recent decades a fourth water regime has emerged that utilizes market mechanisms to allocate water resources. Rising urban and environmental demands for water have caused growing pressure to shift water allocations to the most productive uses and away from agricultural uses that have traditionally held significant amounts of states' water supply, at least in the western United States.[229] The market allows users to trade water permits, and water markets are therefore seen as a powerful tool for facilitating an efficient reallocation of water rights.[230] The idea is that permit holders can trade water extraction rights with others. With a robust market and sufficient trading, the trading market should reflect the level of water scarcity in the area through price signals thereby incentivizing efficient uses.[231] For example, a farmer who

229 *See, e.g.*, Robert Glennon, *Water Scarcity, Marketing, and Privatization*, 83 TEX. L. REV. 1873, 1888 (2005) As Glennon explains, "The transfer of water from farms to cities lessens the pressure to build new dams, to divert even more surface water, and to pump more groundwater. . . . In California, as in most western states, farmers use between 70% and 80% of the state's fresh water. One cannot seriously address the question of new demands for water without focusing on agriculture. . . . The economic value of this water to cities dwarfs the value of the same water to the farmers. It makes economic sense to let the water support the higher value activity." *Id.*

230 *See* Jedidiah Brewer et al., *Transferring Water in the American West: 1987–2005*, 40 U. MICH. J.L. REFORM 1021, 1023 (2007) (reviewing the existing water markets in the different states and analyzing the dynamics of water transfers); Janis M. Carey & David L. Sunding, *Emerging Markets in Water: A Comparative Institutional Analysis of the Central Valley and Colorado-Big Thompson Projects*, 41 NAT. RESOURCES J. 283, 293 (2001) (discussing the key institutional features that are likely to impact that transaction costs associated with water trading); *see generally* Andrew P. Morriss, *Lessons from the Development of Western Water Law for Emerging Water Markets: Common Law vs. Central Planning*, 80 OR. L. REV. 861 (2001).

However, there are also some difficulties in applying water markets. *See, e.g.*, Dellapenna, *supra* note 134; Joseph W. Dellapenna, *Climate Disruption, the Washington Consensus, and Water Law Reform*, 81 TEMP. L. REV. 383 (2008). For an insightful analysis of water markets, see Vanessa Casado-Pérez, Markets and Government: the Case of Water (unpublished J.S.D. dissertation, New York University School of Law) (on file with author).

231 *See, e.g.*, Terry Anderson & Gary D. Libecap, *A Market Solution for Our Water Wars*, DEFINING IDEAS: A HOOVER INSTITUTION JOURNAL (January 12, 2011), http://www.hoover.org/research/market-solution-our-water-wars (last visited Mar. 13, 2015) (discussing how water markets may provide an efficient

previously grew a type of crop that used substantial amounts of water, she may change her crops to those that use less water and sell off her "extra" permits. That way, water allocations will shift from wasteful uses to more efficient ones through the market mechanism. An example of a water market can be found in California.[232]

2. *Creating Wind Markets*

It may also be advantageous to set up markets that allow for trading units of wind energy extraction. Such a trading scheme could facilitate the exchange of wind-energy units within the same 'wind basin.'[233] Each unit would define how much energy could be extracted from a single wind basin or wind stream, and the parties could bargain and transfer the rights to extract wind, allowing the most efficient siting of the turbines to take place through the market system. Another way of thinking of this could be similar, but conceptually opposite, to emissions trading schemes such as the Acid Rain regime under the Clean Air Act in the United States[234] or the carbon trading regimes[235] established in the

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solution to problems of scarcity, and noting that "[w]here water markets are being allowed to work, prices reflect scarcity and trades provide incentives to conserve").

232 *See* Vanessa Casado-Pérez, *Missing Water Markets: A Cautionary Tale of Governmental Failure*, 23 N.Y.U. ENVTL. L.J. 157 (2015); JEDIDIAH BREWER ET AL., NAT'L BUREAU ECON. RESEARCH , PAPER NO. 13002, WATER MARKETS IN THE WEST: PRICES, TRADING, AND CONTRACTUAL FORMS (2007), http://www.nber.org/papers/w13002; *see generally* Richard Howitt & Ellen Hanak, *Incremental Water Market Development: The California Water Sector 1985-2004*, 30 CAN. WATER RESOURCES J. 73 (2005).

233 I use the phrase 'wind basin' to draw on the term 'water basin' or 'watershed.' *See, e.g.*, George Cameron Coggins, *Watershed as a Public Natural Resource on the Federal Lands*, 11 VA. ENVTL. L.J. 1, 13 (1991); A. Dan Tarlock, *Reconnecting Property Rights to Watersheds*, 25 WM. & MARY ENVTL. L. &POL'Y REV. 69, 70 (2000); J.B. Ruhl, *The (Political) Science of Watershed Management in the Ecosystem Age*, 35 J. AM. WATER RESOURCES ASS'N 519, 522 (1998).

234 42 U.S.C. § 7651b (2006). Title IV of the Clean Air Act sets up a trading regime that allows emitters to trade units of emissions of sulfur dioxide (SO_2). *See, e.g.*, Jonathan Remy Nash & Richard L. Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 ECOLOGY L.Q. 569, 582–98 (2001) (discussing air pollution trading programs). Similarly, the California South Coast Air Quality Management District set up a local emissions trading scheme for trading SO_2 in the Los-Angeles area. Robert N. Stavins, *A Meaningful U.S. Cap-and-Trade System to Address Climate Change*, 32 HARV. ENVTL. L. REV., 293, 300–01 (2008) (describing the Los Angeles regime); *see also* Robert W. Hahn & Gordon

Northeastern states of the United States,[236] in California,[237] and in the EU.[238] Instead of stipulating how much one can put in the air, the wind trading regime would define how much one can take out of the air.

To clarify, such a wind market aims to facilitate trade in the rights to use the kinetic energy within the wind. Such a market would be separate from markets for trading in the electricity that is

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L. Hester, *Marketable Permits: Lessons for Theory and Practice*, 16 ECOLOGY L.Q. 361, 371–72 (1989) (describing other emissions trading practices under the Clean Air Act, including netting, offsets, and bubbles); Robert W. Hahn & Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109, 119–29, 132–36 (1989) (describing offsets, bubbles, and netting); *see generally*, Richard B. Stewart, *Privprop, Regprop, and Beyond*, 13 HARV. J.L. & PUB. POL'Y 91, 94 (1990); James E. Krier, *Marketable Pollution Allowances*, 25 U. TOL. L. REV. 449 (1994) (discussing the idea of an emissions trading system as alternative to a "command and control" regime).

235 There is much scholarly and policy attention given to marketable permits in the context of greenhouse gases. *See, e.g.*, Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 712–13 (1999); Daniel A. Farber, *Pollution Markets and Social Equity: Analyzing the Fairness of Cap and Trade*, 39 ECOLOGY L.Q. 1, 2 (2012); Carol M. Rose, *Expanding the Choices for the Global Commons: Comparing Newfangled Tradable Allowance Schemes to Old-Fashioned Common Property Regimes*, 10 DUKE ENVTL. L. & POL'Y F. 45, 51 (1999); Stavins, *supra* note 234, at 300.

236 REGIONAL GREENHOUSE GAS INITIATIVE, http://www.rggi.org/design/regulations (last visited Sept. 15, 2015).

237 CAL. CODE REGS. tit. 17, § 95801 (2015); *Cap-and-Trade Program*, CALIFORNIA AIR RESOURCES BOARD, http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm (last visited Sept.15, 2015). California and Quebec agreed to integrate their cap-and-trade markets in 2013. *Agreement between the Cal. Air Resources Board and the Gov. of Quebec Concerning the Harmonization and Integration of Cap-and-Trade Programs for Reducing Greenhouse Gas Emissions*, CALIFORNIA AIR RESOURCES BOARD, http://www.arb.ca.gov/cc/capandtrade/linkage/ca_quebec_linking_agreement_english.pdf (last visited Sept. 25, 2013); *see California and Quebec Sign Agreement to Integrate, Harmonize their Cap-and-Trade Programs*, CALIFORNIA AIR RESOURCES BOARD (Oct. 1, 2013), http://www.arb.ca.gov/newsrel/newsrelease.php?id=508.

238 Directive 2003/87/EC of the European Parliament and of the Council of the European Union, Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC, Oct. 13, 2003, O.J. (L 275, 25.10.2003) 32, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02003L0087-20140430&from=EN; *The EU Emissions Trading System (EU ETS)*, EUROPEAN COMMISSION, http://ec.europa.eu/clima/policies/ets/index_en.htm; Susan J. Kurkowski, *Distributing the Right to Pollute in the European Union: Efficiency, Equity, and the Environment*, 14 N.Y.U. ENVTL. L.J. 699–700 (2006) (discussing the EU emissions trading system).

created from wind power or the renewable credits that are generated through various tax mechanisms or renewable portfolios.[239] Rather, a wind market in this context is only meant to enable users to trade the rights to use energy within the wind itself, in the same way that water quotas are traded through the market systems to allow for more efficient allocation of the resource.

Setting up a trading program requires, first, defining the set of entitlements individuals have and which they can trade.[240] The initial allocation of rights (before they are traded) can be done through any number of systems,[241] including the mechanisms discussed above for allocating wind rights.[242] In order to facilitate trade wind rights need to be accurately defined, since trade will not take place unless there is sufficient certainty regarding the rights to use the resource.[243] This may be particularly challenging regarding wind, since defining the wind current along which trading can take place might be more complicated than establishing, for example, water basins. For that reason, not all of the property regimes discussed above can serve as an underlying basis for creating a trading system. Particularly, a traditional riparian regime might not be suited to allocate rights for the purpose of trading due to the uncertainties associated with the definition of rights under such a

239 *See Database of State Incentives for Renewables & Efficiency*, *supra* note 19, for an overview of current state incentives regarding renewable energy and efficiency.

240 Defining the commodity is a necessary element for the development of a market in that specific commodity. *See, e.g.*, BLAS LUIS PÉREZ HENRÍQUEZ, ENVIRONMENTAL COMMODITIES MARKETS AND EMISSIONS TRADING: TOWARDS A LOW-CARBON FUTURE 29–30 (2013) (discussing the requirements outlined in the economic literature for setting up a market, and specifically the notion of an "environmental commodity").

241 In that sense, a trading scheme can actually be seen as a subset of any property regime, whether the property interests are allocated and governed by the administrative system or the judiciary. Since property rights are alienable and subject to transfer, once such rights are established, efficient trading can take place. Accordingly, once wind rights are recognized as a property interest that can be protected and transferred, the right to extract energy from the wind can also be traded. Setting up some kind of a property regime is thus the basis for initiating a market.

242 *See supra* Part IV.A (applying riparianism to wind), Part IV.B (applying prior appropriation to wind) and Part IV.C (applying regulated riparianism to wind).

243 *See* Rose, *supra* note 212, at 59; Carol M. Rose, *What Governments Can Do for Property (and Vice Versa)*, THE FUNDAMENTAL INTERRELATIONSHIPS BETWEEN GOVERNMENT AND PROPERTY 259, 284 (Nicholas Mercuro & Warren J. Samuels eds., 1999) (likewise asserting the importance of defined rights).

regime. A prior appropriation regime, however, could perhaps serve as a mechanism for allocating rights prior to trading since it provides more definitive property rights.[244] Likewise, a regime similar to regulated riparianism could be used to set up the basic rights that are traded. This would mean that individuals would obtain permits to extract energy from the wind, and then trade these permits.[245]

In other words, of the regimes discussed above, the ones suitable for serving as a base-line for the market are the prior appropriation regime and the regulated riparianism regime (or an equivalent administrative permitting system). In principle either could serve as a basis for setting up a market. Yet, for reasons discussed above, the administrative permitting system is likely the most favorable regime for governing the wind resources.[246] Thus, this Note suggests that combining the permit regime with a marketable scheme would be most beneficial. In areas with increased competition, the combination of the permitting system and the market mechanism is most fruitful. In fact, most of the trading regimes involving air, such as acid rain or carbon markets, are premised on a similar notion, where property interests are allocated to the individual users through a system that is fashioned and governed by the administrative system and are then traded by the individual users.[247] The combination of an administrative

244 However, note that the "no-injury rule," which stipulates that the transfer of rights in the prior appropriation system cannot injure a more junior recognized user, might complicate the transfer and trading of rights. *See* GETCHES, *supra* note 145, at 109.

245 To clarify, while this suggestion implies that government should use permits to facilitate trade, it does not necessarily mean that such permits would be identical in nature or process to the ones discussed above in the regulated riparianism section. Permits that are set up with the intention of facilitating trade could vary in their structure and goals. Both the process and the outcome of these two types of permits could be very different.

246 *See supra* Part IV.C.

247 *See* Stewart, *supra* note 234, at 94; Krier, *supra* note 235, at 453; Rose, *supra* note 212, at 51.

Importantly, the method of the initial allocation of allowances in these trading regimes does not necessarily follow a 'regulated riparianism' model. Often, trading allowances are distributed on the basis of historical usages ('grandfathering'). *See* Jonathan Remy Nash, *Too Much Market? Conflict Between Tradable Pollution Allowances and the "Polluter Pays" Principle*, 24 HARV. ENVTL. L. REV. 465, 505 (2000); *see generally* Jonathan Remy Nash, *Allocation and Uncertainty: Strategic Responses to Environmental Grandfathering*, 36 ECOLOGY L.Q. 809 (2009). It is also possible to auction off

permitting system and the trading regime thus seems most advantageous for governing an airborne fugitive resource such as the wind.

In any case, as demonstrated above, at present given the lack of existing judicial or legislative guidance on the subject, wind rights are currently not well-defined and their status is mostly uncertain. Therefore, the first step in establishing a wind market should be establishing better defined wind rights.

A second challenge in the application of a wind market might be protecting 'in-stream' uses, so as to allow for the continued flow of airstream for environmental or recreational purposes.[248] Put differently, protecting the ecosystem values of wind through the market scheme could be challenging, as ecosystems are often undervalued, and those concerned with protecting the ecosystems might be subject to collective action problems or might not be able to raise the funds necessary to purchase the required wind rights.

There are several other questions regarding the shape and content of wind markets that are yet to be resolved. There may be questions concerning, such as: how we define wind basins; how much wind should be extracted; what kind of trading mechanism do we use; how we should deal with existing users (grandfathering); and much more. Discussing all these questions in detail is beyond the scope of this Note. Moreover, given the current stage of the development of wind regimes, and the fact that too many pieces of the puzzle are still missing, an analysis of these details is probably premature. This Note intends to suggest that market mechanisms can be beneficial for managing the use of wind in areas where the extraction of wind is intensive and competitive. The aim is merely to lay out a framework, and set the ground for future discussion.

Despite the difficulties mentioned, wind markets present a promising mechanism for regulating wind. Marketable trading schemes are considered to be particularly advantageous for facilitating interactions among strangers, and they are believed to

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the tradable permits. *See, e.g.*, Stavins, *supra* note 234, at 317–21; Nash &Revesz, *supra* note 234, at 575–76. The issue of initial allocation of permits is no doubt a very significant one, although a full-analysis of how wind rights would be initially allocated is beyond the scope of this Note.

248 For an analogous discussion in the context of water, see Paul R. Williams & Stephen J. McHugh, *Water Marketing and Instream Flows: The Next Step in Protecting California's Instream Values*, 9 STAN. ENVTL. L.J. 132 (1990).

be especially suited for widely dispersed resources.[249] Being a widely distributed and scattered resource, wind is suitable for trading. Siting the wind turbines through the market system would allow for the most efficient location and levels of extraction to be determined through the market system, and accounting for the costs and benefits associated with the production. A trading scheme is also considered the most cost-efficient solution,[250] which can achieve the result of efficient siting and optimal use of the wind.

Moreover, since developers and producers are in the best position to obtain information regarding the costs of construction and electricity production, they can also decide if and when to invest in wind-energy. At the same time, the data regarding meteorological and geographical conditions or aggregated effects of energy extraction can be considered by the administrative system allocating the tradable permits.

Lastly, the market system could allow for increased flexibility in wind rights allocation,[251] enabling it to respond both to changes in production and technology costs (since producers will buy or sell energy units depending on their costs of production and the price of electricity), as well as environmental concerns (by controlling the amount of permits allocated). While establishing a wind market in rural areas with vast wind resources and few users may be unnecessary, in areas where the use of wind resources is competitive and conflict over the use of wind is more frequent,[252] such wind markets could be effective.

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249 Rose, *supra* note 22, at 68; *see generally* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171 (1988).

Another example of market-based regimes controlling widespread hazards or resources can be found in trading of fishing quotas. *See* Katrina M. Wyman, *From Fur to Fish: Reconsidering the Evolution of Private Property*, 80 N.Y.U. L. REV. 117, 155–57 (2005) (reviewing the development of individual transferable quotes in fisheries).

250 *See* Stavins, *supra* note 234, at 298; *see generally* Ackerman & Stewart, *supra* note 249.

251 *See* Stavins, *supra* note 234, at 329–30 (discussing the flexibilities of a CO_2 cap-and-trade regime).

252 *See infra* Part I.A (discussing the conditions under which conflicts over the use of wind are more likely to arise).

CONCLUSION

Wind presents a promising, clean, resource for energy production, which is likely to become even more significant in years to come due to the challenges of climate change. Wind also carries significant ecological and recreational value. Although wind can replenish itself, it is not infinite on a local scale because extracting kinetic energy from wind leaves less energy available in the downwind direction. As a result, conflicts can arise. Despite the apparent importance of wind resources, there is very little judicial or legislative guidance on the governance of wind.

This Note therefore attempts to outline the structure of a wind regime such that the externalities associated with the uncontrolled use of wind would be accounted for; the wind resources would be protected put to the most efficient use. Drawing on more mature regimes governing water, a similarly fluid and fugitive asset, provides helpful lessons for crafting wind law. After examining the application of four water regimes to wind resources, this Note concludes that an administrative permitting system that resembles the 'regulated riparianism' regime is best suited for a majority of the country. This is due to its ability both to provide investors with the necessary certainty of profit and to reasonably account for public interests. Once the property interests in wind are defined through the permits, they can also be traded, so that wind markets, in addition to permitting systems, allowing permit holders to trade wind permits and encouraging the most efficient siting to take place through the market system. Such regimes may be unnecessary in rural areas with vast wind resources and very few users, but may be especially useful in areas where the use of wind is more competitive. The most competitive settings occur where the users are clustered together, such as urban areas. For those rural areas with abundant wind resources, where there are likely to be fewer conflicts over the use of wind, a regime such as 'traditional riparianism' may be appropriate, and in fact is already the de facto regime in some regions today.

Naturally, there are still many unanswered questions and unexplored realms in the effort to fashion a comprehensive wind regime. For example, even once the type of regime has been outlined, there remain questions of which level of government is best suited to address the issues of wind governance. To draw another analogy, water law is typically within state jurisdiction.

This could suggest that wind law should be dominated by state regulation as well. Localized governance enables beneficial tailoring to the specific needs and characteristics of each location. However, other fugitive assets, such as clean air, are federally regulated. Arguably, the same considerations that led to federal regulation of the particles in air could also dominate regulation of the movement of air. Further, if wind was to be primarily regulated by the states, there could be problems with interstate wind externalities. In other words, the same adversarial wind conflicts that exist in a local setting could eventually materialize on a larger scale, and one state could suffer the depleted wind current caused by the vigorous wind use of its neighboring state.[253] Moreover, this problem could also materialize on an international level, calling into question the management of cross-boundary resources.

The nuances and intricacies of these regimes would need to be addressed at a later stage, such as mechanisms for applying for permits or the ways in which 'wind-basins' would be defined for the purpose of rights allocation. There are indeed many details within the suggested regimes that are not addressed in this Note. The analysis of these complex issues, and other issues that pertain to the establishment of new wind rights, is however, left for another day, as this Note merely attempts to lay down a general outline for crafting the new wind regimes, to establish a framework, and to set the stage for future discussion.

Indeed, the analysis of wind law is clearly far from reaching its full scope, and further research is still needed to establish a widespread wind regime. Yet laying down an outline for the wind regimes is nonetheless important at present, since wind energy raises some striking challenges to resource allocation and management. These issues should be addressed in fashioning the future wind regimes, so that we can all enjoy the full financial and environmental potential of wind for many years to come.

253 A similar problem could indeed arise in other contexts, including interstate air pollution. *See, e.g.*, Richard L. Revesz, *Federalism and Interstate Environmental Externalities*, 144 U. PA. L. REV. 2341, 2343 (1996). A full analysis of this issue is, however, beyond the scope of this Note.